RESEARCH ARTICLE

Perceptions of technology-enhanced learning in undergraduate medical education at a private medical college in Karachi, Pakistan

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Abstract

Objective: To identify perceptions of key stakeholders in a private medical college for the adoption of technology-enhanced learning at the undergraduate level.

Methods: The mixed-method study was conducted at the Aga Khan University Medical College in Karachi from May 2014 to May 2015. Data was collected from students, faculty and academic programme leaders through questionnaires, focus group discussions (FGDs) and semi-structured interviews. SPSS 19 was used for quantitative data analysis. Qualitative data was analysed by generating codes and themes from the FGDs and interview transcripts.

Results: There was a consensus among the stakeholders regarding the need to incorporate technology-enhanced learning at the undergraduate level to supplement the curriculum, but not as a replacement for face-to-face class sessions. Students and faculty members have access to technology on campus. Students are appropriately digitally literate and use information and communication technology extensively for studies and other communication needs. All faculty members use PowerPoint and videos, and some use other tools, like simulations. The key challenges to technology-enhanced learning use identified included faculty members' skills to incorporate it in teaching, limited opportunities and time to learn the use of technology, poor faculty incentives for teaching innovation, and lack of availability of technical support and appropriate technologies.

Conclusion: Successful adoption of technology-enhanced learning requires changes in the curriculum and pedagogical approaches, preparedness and willingness of the stakeholders, and academic leaders' vision and support to embrace new teaching and learning approaches.

Keywords: Education, Medical, Undergraduate, Educational technology, Technology enhanced learning. (JPMA 69:1108; 2019)

Introduction

Technology-enhanced learning (TEL), defined as the use of digital media technology such as the web, mobile phones and apps, and computers and software in teaching and learning activities across a range of modalities, such as face-to-face, blended and online, is no longer a matter of choice. In countries like Pakistan where the doctor-patient ratio is approximately 1:1100, TEL can not only improve the quality of student engagement, but can also enable future physicians to develop skills to offer medical care through eHealth.

Previous studies have shown that determining e-readiness is a critical step in the curriculum-wide implementation of TEL in medical programmes.[1-4] E-readiness in higher education institutions includes the capacity of institutional stakeholders such as managers, information and communication technology (ICT) persons, teachers and students to create learning opportunities through computer-based technologies.[2] E-readiness also encompasses institutional policy, availability of infrastructures/systems,[2] technical and pedagogical preparedness of faculty and students,[4] and their access to, knowledge of, and attitude towards ICT and expected challenges in its implementation.

The five-year undergraduate medical education (UGME) programme at the Aga Khan University Medical College has an integrated and spiral curriculum that relies on multimodal pedagogical approaches. While the programme is taught via face-to-face modalities, TEL has been used opportunistically since 2004. For example, an internet-based curriculum management system was implemented in 2016. Interactive technologies such as Kahoot, Padlet, and virtual learning environments (VLE), and blended and flipped learning approaches have been utilised by faculty members. However, there has been no systematic approach to incorporate TEL.[5]

Given the importance of TEL for today's students who learn differently with more reliance on technology and digital resources,[6,7] the university has committed to adopting TEL in its UGME programme. The current study was planned to explore current experiences, expectations

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and challenges perceived by faculty, students and programme leaders, and to suggest a way forward for introducing TEL across the UGME programme.

Subjects and Methods

The mixed-method quantitative-qualitative study was conducted at the Aga Khan University Medical College, Karachi from May 2014 to May 2015, and comprised students, faculty and programme leaders. After approval was obtained from the institutional ethics review committee, all faculty members, students from Year 1 to 5 and key academic and administrative leaders directly responsible for supporting the UGME programme were invited to participate.

Data was collected in three stages: questionnaires were used with UGME students and faculty members; focus group discussions (FGDs) were held with UGME students and faculty members; and semi-structured interviews were conducted with programme leaders.

Two questionnaires were developed based on an existing valid scale.[8] The questionnaire for the students included 48 items on demographics, access to ICT, perceptions of ICT capabilities and literacy, and application of TEL in UGME (Table-1). The questionnaire for the faculty was identical to the students' questionnaire with additional items on preferences for types of TEL activities.

For FGDs, students were selected using stratified random sampling. They were divided into five groups, stratified according to their academic years. An email was sent to all students. From the interested and consenting students, four were selected randomly from each stratum. There was no participation from students of Year 4 due to their rotation schedule.

FGDs were conducted with faculty members selected from amongst those involved with the UGME curriculum. An email was sent to faculty members and those who gave consent were invited to participate.

The duration of each FGD was 45-60 minutes. To reduce potential bias, the FGDs were moderated by two members of the research team who were not involved with UGME teaching. The FGDs were audio-recorded with the consent and transcribed.

Four in-depth semi-structured individual interviews were conducted with programme leaders to understand their perspectives and the university's vision for incorporating TEL in UGME. In addition, their expectations and challenges associated with the adoption of TEL were explored. The duration of each interview was 45-60 minutes. The interviews were audio-recorded with the consent and transcribed. To ensure accuracy, transcripts were checked against audio recording and were shared with the participants for member-checking.

Quantitative data was analyzed for frequencies, percentages and mean values using SPSS version 19. For qualitative data, preliminary codes were generated by identifying keywords in the transcripts. These were reviewed, and themes were generated with consensus.

Results

Of the 500 students invited to participate in the quantitative arm of the study, 275 (55.2%) responded. Of these, 155 (56.4%) were females, and 145 (52.5%) were from Years 1 and 2. Of the 300 faculty members approached, 10 (3.3%) volunteered to participate. Of these, 8 (80%) were clinicians, and 2 (20%) were basic scientists. Of the six academic and administrative leaders approached, 4 (66.4%) agreed to participate. Altogether sixteen students participated in two FGDs, with a group of eight students in each FGD. There were 45 participants in the faculty FGDs; 31 (69%) females and 40 (88%) faculty members who held the rank of assistant professor or below participated. Two FGDs were conducted with 19 (42%) basic science faculty members and another two with 26 (58%) clinical faculty members.

The key themes that emerged from data were ICT access

Table-1: Overview of the questionnaire for undergraduate medical students.

Construct	# of items		Description
Demographics	5	New	This part has items related to students' profile, such as, age, gender, location, study year
Access to ICT	7	New	This subscale measures students' ownership and use of ICT devices (e.g. smart phone, laptops, and desktops) and internet at home and university
ICT capabilities: ICT literacy	24	Adopted from Markauskaite, 2007	This subscale measures students' ability to use ICT applications (hardware and software)
ICT capabilities: Problem Solving	10	Adopted from Markauskaite, 2007	This subscale measures students' general capabilities to perform various learning and research tasks using ICT
TEL in UGME	2	New	These items measure students' opinion about the years/courses, where TEL would be more effective for their learning

ICT: Information and communication technology.

Table-2: Students' perceptions of their own technological and ICT-related general cognitive capabilities; mean (SD) of 6-point response scale.

Subscales	Gender		Year of study	
	Male (n=119)	Female (n=154)	Pre-clinical (n=144)	Clinical (n=130)
Basic ICT capabilities	3.94 (0.90)	3.96 (0.78)	3.88(0.81)	4.04(0.86)
Analysis & production capabilities	3.69 (0.92)	3.81 (0.85)	3.62 (0.78)	3.91 (0.96)
Information & internet-related capabilities	3.39 (0.86)	3.33 (0.79)	3.34 (0.76)	3.38 (0.88)
Problem solving capabilities	3.80 (0.72)	3.67 (0.71)	3.68 (0.64)	3.64 (0.69)
Communication & metacognition	3.70 (0.77)	3.67 (0.73)	3.76 (0.69)	3.50 (0.70)

Scale key: 0 = don't have the ability; 1 = not at all confident; 2 = not very confident; 3 = moderately confident; 4 = quite confident; 5 = totally confident was used.
ICT: Information and communication technology.
SD: Standard deviation.

and literacy, prior experiences, expectations and anticipated challenges of using TEL, and institutional readiness for TEL (Figure).

Among the students, 265 (96.3%) reported that they had access to laptops, and 272 (99%) reported to have access to the Internet at the university, while 274 (99.6%) had access to the Internet at home as well, with 179 (65%) using it everyday. Overall, 233 (85.7%) students reported using the Internet for social networking and communication which was followed closely by using the Internet for study purposes by 220 (80.3%). Further, 140 (50.7%) students said that TEL should be incorporated across all five years of the UGME curriculum.

Perceptions of students' ICT literacy were measured in

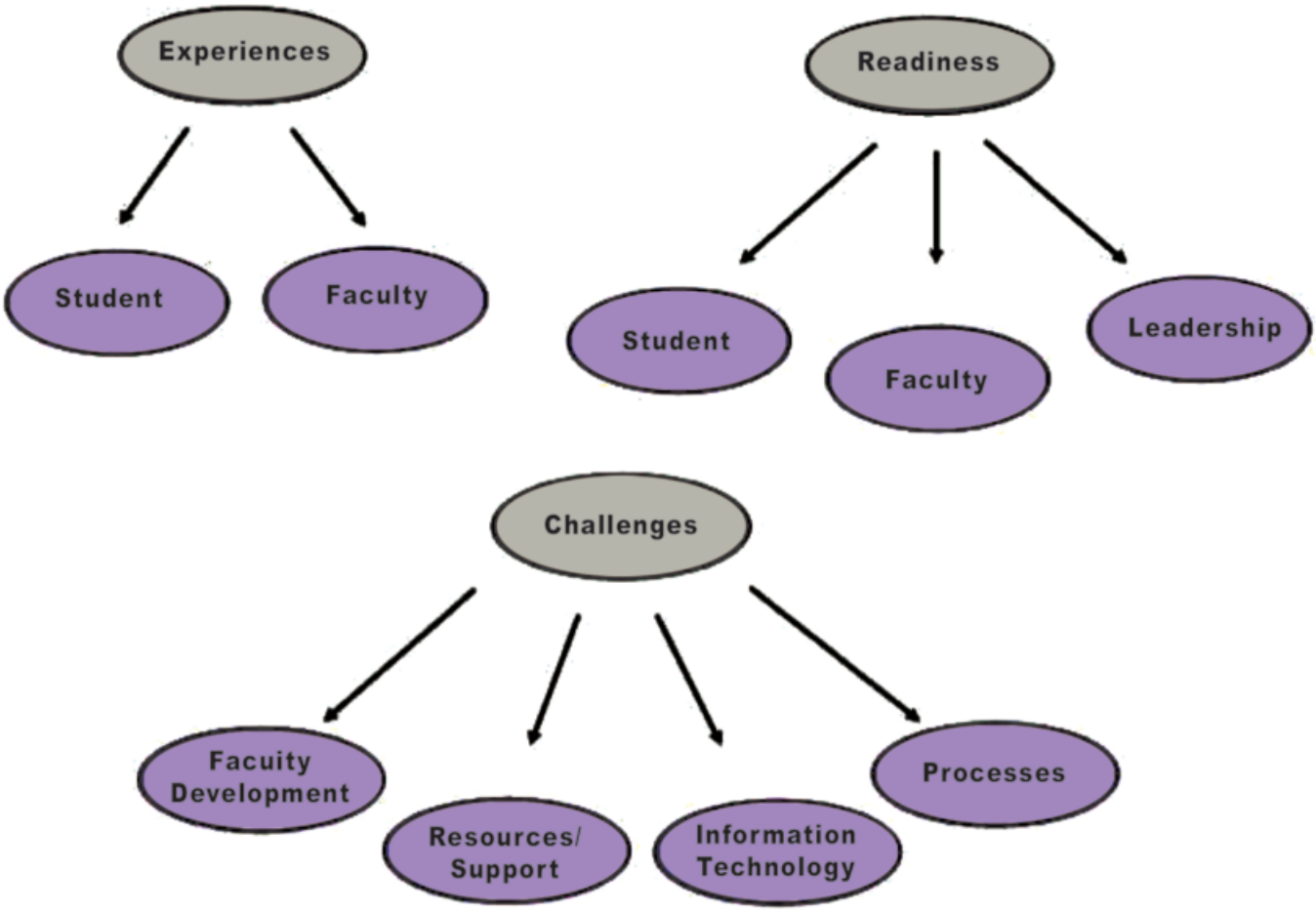

Figure: Perspective on the use of technology-enhanced learning (TEL) in undergraduate medical education (UGME).

terms of their ICT capabilities, i.e. ability to use ICT hardware and software, and problem-solving capabilities, i.e. ability to perform various learning and research tasks (e.g., for studies at university, research for studies or for personal needs).[8] On average, students were found to be 'moderately confident' to 'quite confident' regarding their own basic ICT capabilities (Table-2).

The faculty members were 'quite confident' of their problem-solving capabilities, and communication and metacognition with a mean score of 5.1 (SD=0.33). They were 'moderately confident' to 'quite confident' regarding their basic ICT capabilities with a mean score of 5.5 (SD=0.64), analysis and production mean score of 4.4 (SD=0.78), and information and Internet-related capabilities with a mean score of 4.8 (SD=0.51). Nine (90%) faculty members agreed that TEL could be used in the entire curriculum.

The FGDs revealed that the experiences of TEL differed between students and faculty members. Students had utilised a wider range of resources for learning, such as medical dictionaries, e-books, mobile apps related to clinical examinations (for example, Epocrates) on their smartphones, and videos (for example, to study embryology and anatomy) for self-learning. Those students who had used a VLE found it user-friendly.

Faculty members' prior TEL experiences included the use of presentation software, videos, three-dimensional (3D) images, webinar, mobile apps, online quizzes, and virtual labs. While two (10%) faculty members had attended formal trainings, 18 (90%) faculty members had learnt to use technology by trial and error or with help from colleagues. They recognised that students are adept at using technology for learning. There was a general consensus that a big advantage of TEL is to provide instant access to information which would better engage students. A clinical faculty member mentioned: "*During the reporting session of [an] unfamiliar syndrome, students take out their mobile [phones] and reply in 30 seconds that these are the features and the presentation...they don't have to go to the library and search for a book...they all are connected with each other…they just Google it!" (CF04).*

Most faculty members preferred to adhere to the existing methods of teaching which included lectures. Both students and faculty members agreed that TEL should supplement and not replace face-to-face teaching. The faculty emphasised that face-to-face interactions were important to teach certain difficult concepts and for effective role-modelling. Faculty members mentioned that technology-enabled flipped classrooms could enable them to use class time for higher cognitive activities. While the students appreciated the idea, they were concerned about excessive homework and emphasised that flipped classroom would only be useful if the face-to-face sessions were used for faculty-student interactions and higher order learning activities.

One student pointed out: "Maybe we are not used to it [online lecture], so we can't really imagine having a lecture where your lecturer isn't there physically" (ST06).

The students pointed out that online learning could enable them to attend classes when they are unable to come to the campus because of political instability in the city. They recommended changes in the institutional attendance policy would be required.

In semi-structured interviews, the leaders supported the idea of integrating TEL in the UGME programme. While being critical of the existing didactic teaching methods, they suggested that faculty members should be prepared for TEL in UGME.

"*Approaches to teaching here are very up-to-down, you know, and teachers expect students to learn textbooks by heart, rote-learning rather than understanding. And I think by using technology it will be an opportunity to change the pedagogical perspective at least of some teachers, and the way courses are given" (L1).*

In addition, TEL was seen as an opportunity to increase teaching efficiency: "*…we should be as effective as possible in teaching because our biggest costs, naturally, are people. So you want to make the most use of the people" (L1).*

Most leaders were positive about the university's investment in the ICT infrastructure and other services to provide a technology-rich learning environment for students. The establishment of the Centre for Innovation in Medical Education (CIME), a recently inaugurated state-of-the-art, multi-purpose facility with integrated digital infrastructure, was mentioned as an example. However, one leader disagreed and identified a disconnect between university leaders' vision and the ground reality. It was mentioned that there was a lack of commitment by the university leadership to use technology in UGME. It was suggested that there was a need to seek "*the commitment from the top and then the resources [would follow]"* (L2). These resources included the availability of trained support staff and improved infrastructure. Another leader mentioned that availability of champions of the TEL's cause within the institution was critical for its successful implementation. It seemed that there was resistance to adopting TEL in the university as there was a perception that it would increase faculty workload.

All three groups from whom data was collected highlighted faculty's limited knowledge and skills to use TEL as the most fundamental challenge. This included faculty members' skills to design and teach courses incorporating TEL, and how quickly faculty members could be trained. A leader pointed out: "*… we have to invest in faculty development and provision of infrastructure and ensuring that people actually find it beneficial at the end of the day*" (L3).

It was noted, in particular by basic science faculty, that teaching was not given the same priority as research at the time of promotion and appraisal. In addition, there was a recognition that most clinical faculty members had high service workload. Therefore, investing time on learning new skills and technologies and revamping teaching was not a priority. Hence, even if courses or workshops were offered, faculty lacked the time to attend those or to change their teaching practice. In this case, the role of leaders was considered crucial in ensuring the provision of protected time and due recognition for faculty members' contributions to innovation in teaching.

The responses indicated that a lack of necessary support for faculty to design technology-based courses, inadequate ICT infrastructure, technical proficiency of the support staff and high cost associated with creating interactive media content, were also challenges. The leaders believed that older faculty members, as immigrants to the digital age, might offer more resistance to adopt TEL than the younger ones.

Students mentioned seeking copyright clearance of material available online and intellectual property of the e-resources developed by students as potential challenges. Faculty mentioned maintaining the confidentiality of patients' data, if it is used in online courses, as a challenge.

Faculty members stated they would need formal training in the use of TEL. They preferred to have brief tailor-made trainings in face-to-face or blended format during week-days. All faculty members agreed that there should be trained and dedicated support available to help them develop TEL resources, particularly in the light of faculty time constraints and competing demands. Students identified technology as useful for on-going self-evaluation of learning. They proposed that students could work as Teaching Assistants and help faculty members in designing online self-assessment activities. Both faculty and students highlighted the need to upgrade the ICT infrastructure for better access to high-speed Internet and better devices on the campus before implementing TEL in UGME.

The faculty members believed that TEL would be effective across all five years of the UGME programme. However, it should first be incorporated within the first two years. Basic science faculty mentioned that any component of the first two years could be taught using TEL, although this would require extensive course re-design. In clinical disciplines, the faculty agreed that TEL resources could be used to ensure systematic learning (for example, through the use of virtual patients or videos when real patients with a particular pathology were not available) and standardised understanding of clinical and communication skills (for example, history-taking, dealing with difficult patients, breaking bad news). Further, they identified surgery courses as ideally suited for TEL. They proposed using TEL to teach complex procedures and practice skills that were difficult, dangerous or culturally unacceptable (for example, male students are often not allowed in the delivery room due to patient refusal) to teach on real patients. Finally, faculty members recommended that there should be a mechanism for quality assurance of the TEL resources developed and used.

Discussion

The current study identified the usage level of TEL in UGME, highlighting the gaps and issues in order to define a path for its curriculum-wide integration. The perceptions reported have revealed that almost all medical students at the university had easy access to computers, including smartphones, and the Internet, both on-campus and at home. A previous study from a developed country reported that male medical students scored higher in technological readiness, attitude and innovation.[9] Kennedy et al. reported that clinical year students were more capable of using distinct technology-based tools.[10] However, our study showed no difference in technological readiness between male and female or junior and senior students. This may be attributed to the fact that students at the university are as advantaged as medical students in the developed countries[11] and similarly adept at using devices such as smartphones and tablets for learning.[12]

There was a common perception that the use of TEL would lead to enhanced student engagement, which has been reported previously in literature.[13] Curriculum designers across all study years recognise the importance of using TEL in medical education to enhance efficiency and outcomes of teaching and learning.[14] TEL is to be used to strengthen face-to-face and clinical teaching, and not as a replacement.[15] The challenge will be to use TEL in clinical rotations so that it maintains student engagement but also does not affect patient communication and

care.[16]

Provision of protected time for faculty development and recognition of teaching innovation have been identified as challenges previously.[15,17,18] Today, teaching hospitals are concerned about their financial bottom lines. When physicians are under pressure to increase clinical service workload, the quality of teaching is affected. Therefore, protected time away from clinics, and a compensation model where those interested in teaching are not penalised financially or at the time of promotions could improve teaching in medical colleges. Alongside, provision of support for faculty to learn and use TEL is needed. Furthermore, to ensure that international intellectual property laws are followed when developing or utilising e-resources, staff training on copyright is needed.

The findings reveal a disconnect between faculty and leaders' perceptions of the organisational readiness for adopting TEL. While the leaders thought the organisational policies and infrastructure were supportive for adopting TEL, the faculty felt otherwise. Perceptions of institutional inertia posed challenges for a curriculum-wide adoption of TEL. This disconnect could be improved through communication of shared goals between leadership and faculty.

There was a lack of faculty participation in the quantitative arm of the study. This may reflect time constraints, but may also suggest a lack of interest or commitment towards adopting TEL. Self-selection bias in FGDs by faculty already invested in medical education was apparent, but we felt it necessary to include their perspectives as they will be important stakeholders in the implementation process.

Conclusion

All stakeholders expressed enthusiasm regarding formal incorporation of TEL in UGME. TEL was identified as a priority aligned with the available infrastructure and expectations of the institutional leaders with regards to faculty and student performance. Findings suggest that successful TEL integration largely depended on enhancing the status of teaching compared to clinical service work in the medical college, and adequate investment in faculty development and infrastructure enhancement.

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References

1. Eslaminejad T, Masood M, Ngah NA. Assessment of instructors' readiness for implementing e-learning in continuing medical education in Iran. Med Teach. 2010; 32:e407-12.
2. Frehywot S, Vovides Y, Talib Z, Mikhail N, Ross H, Wohltjen H, et al. E-learning in medical education in resource constrained low- and middle-income countries. Hum Resour Health. 2013; 11:4.
3. Machado C. Developing an e-readiness model for higher education institutions: results of a focus group study.[Online] [Cited 2006 May 09]. Available from: URL: https://doi.org/10.1111/j.1467-8535.2006.00595.x
4. Mantilla G, Lewis K. Determining faculty and student readiness for an online medical curriculum. Med Sci Educator. 2012; 22:228-43.
5. Naseem A, Ghias K, Sabzwari S. Technology-enhanced learning in medical education: experiences from a developing country. In: Nata RV, Naseem A, Ghias K eds. Progress in Education. USA: Nova Science Publishers, 2017; pp-159-69.
6. Prensky M. Digital natives, digital immigrants Part 1. On the Horizon. 2001;9(5):1-6.
7. Ruiz JG, Mintzer MJ, Leipzig RM. The impact of E-learning in medical education. Acad Med. 2006; 81:207-12.
8. Markauskaite L. Exploring the structure of trainee teachers' ICT literacy: the main components of, and relationships between, general cognitive and technical capabilities. Educ Tech Res Dev. 2007; 55:547-72.
9. Caison AL, Bulman D, Pai S, Neville D. Exploring the technology readiness of nursing and medical students at a Canadian University. J Interprof Care. 2008; 22:283-94.
10. Kennedy G, Gray K, Tse J. 'Net Generation' medical students: technological experiences of pre-clinical and clinical students. Med Teach. 2008; 30:10-6.
11. Vafa S, Chico DE. A needs assessment for mobile technology use in medical education. Int J Med Educ. 2013; 4:230-5.
12. Fan S, Radford J, Fabian D. A mixed-method research to investigate the adoption of mobile devices and Web2.0 technologies among medical students and educators. BMC Med Inform Decis Mak. 2016; 16:43.
13. McCoy L, Pettit RK, Lewis JH, Allgood JA, Bay C, Schwartz FN. Evaluating medical student engagement during virtual patient simulations: a sequential, mixed methods study. BMC Med Educ. 2016;16:20.
14. Ellaway R, Masters K. AMEE Guide 32: e-Learning in medical education Part 1: Learning, teaching and assessment. Med Teach. 2008; 30:455-73.
15. Ferguson Z. Technology-enhanced learning should be employed alongside - not instead of - bedside teaching. Adv Med Educ Pract. 2016;7:49-50.
16. Quant C, Altieri L, Torres J, Craft N. The self-perception and usage of medical apps amongst medical students in the United States: a cross-sectional survey. Int J Telemed Appl. 2016; 2016:3929741.
17. Schiekirka-Schwake S, Anders S, von Steinbuchel N, Becker JC, Raupach T. Facilitators of high-quality teaching in medical school: findings from a nation-wide survey among clinical teachers. BMC Med Educ. 2017; 17:178.
18. Crichton S, Naseem A. Blended Work-Experiences From International Development Projects. In: S Hirtz, K Kelly, eds. Education for a Digital World 2.0, Innovations in education. Canada: Crown Publications, 2011.