



Ownership and Attitudes towards Technology Use in Physiotherapy Students from Seven Countries

Dirk Vissers^{a,*}, Michael Rowe^b, Md. Shofiquel Islam^c, Jan Taeymans^d

^aDept. of Rehabilitation Sciences and Physiotherapy, Fac. of Medicine and Health Sciences, University of Antwerp, Antwerp, Belgium

^bDept. of Physiotherapy, Fac. of Community and Health, University of the Western Cape, Bellville, South Africa

^cDept. of Physiotherapy, Bangladesh Health Professions Institute, The Academic Institute of the Centre for the Rehabilitation of the Paralysed, Savar Dhaka, Bangladesh

^dDept. of Physiotherapy, Health, Bern University of Applied Sciences, Bern, Switzerland

Received 25 August 2017; received in revised form 15 November 2017; accepted 2 December 2017

Abstract

Purpose: To assess differences in prerequisites to blended learning such as technology use and Internet access in an international sample of physiotherapy students from Bangladesh, Belgium, Brazil, Luxembourg, Sudan, Switzerland and South Africa.

Results: Students' digital technology experiences were generally low. They primarily used a smartphone and a laptop to connect to the Internet. However, there was a significant difference between institutions in owning a laptop and access to Internet. Most students preferred learning in environments that included some online components but had never used Twitter or written a blog post and wanted less social media in their learning environments.

Conclusion: Physiotherapy students would prefer an increase in the use of digital tools in their learning. However, differences in technology use and access highlight the challenges inherent to offering international online courses. Therefore decisions around online and blended course design in health professions education must be made with caution.

© 2017 King Saud bin AbdulAziz University for Health Sciences. Production and Hosting by Elsevier B.V. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Keywords: Higher education; Physiotherapy; E-learning; Blended learning; Social media

1. Introduction

There are concerns that current approaches to clinical education do not adequately prepare health professional students to meet the needs of the population, in that

they do not graduate students who are prepared for independent practice in increasingly complex health systems.¹ These complex systems are characterized by rich, non-linear interactions that make them ambiguous and uncertain, lacking predictable outcomes or clear boundaries.² The knowledge and skills required to work and thrive within a modern health system are so diverse that it is impossible for a single individual or profession to affect meaningful change.¹⁻³ Partly in response to these concerns the World Health Organisation (WHO) has called for the transformation and scaling up of

*Correspondence to: University of Antwerp, Dept. of Rehabilitation Sciences and Physiotherapy, Campus Drie Eiken, Universiteitsplein 1, 2610 Wilrijk, Belgium.

E-mail address: dirk.vissers@uantwerpen.be (D. Vissers).

Peer review under responsibility of AMEEMR: the Association for Medical Education in the Eastern Mediterranean Region.

<https://doi.org/10.1016/j.hpe.2017.12.003>

2452-3011/© 2017 King Saud bin AbdulAziz University for Health Sciences. Production and Hosting by Elsevier B.V. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

health professions education in order to improve the quality and relevance of health professionals in their respective countries.³

The result has been a call for educational reform to break down professional silos while at the same time enhancing collaborative and non-hierarchical relationships in teams.¹ A physiotherapy curriculum that aims to achieve these outcomes should use the knowledge and expertise of international colleagues. These networks and partnerships between educational and health care institutions would enable educators and students to bypass local resource constraints (in terms of knowledge and experience) and establish regional and global partnerships that enhance health professional education.¹

In addition to these specific challenges in health professions education, there also exist broad drivers of change in the higher education sector. These include the massification of education, the impact of information and communications technology, and the rise of the global knowledge economy.⁴ Internationalization in higher education has been highlighted as having increasing importance as it provides intellectual and cultural benefits that help students develop as professionals.^{5–7} The term 'internationalization at home' has been used in Europe to indicate the importance of having an international experience, even for students who have not travelled abroad.⁷

Blended learning has been suggested as an option for educators to address these challenges in health professions education, where face-to-face engagement is integrated with online interaction so that the strengths of each environment are leveraged to enhance students' learning.⁸ This approach to technology integration seems to have a positive effect on knowledge acquisition and on developing clinical competencies in health professions students.^{9–11} There is also evidence to suggest that the appropriate use of technology can facilitate the development of skills and attributes like critical thinking and self-directed learning, as well as changing power relationships between teachers and students. This shift of emphasis from teachers to students makes the relationships between knowledge, authority and power visible and explicit, which enables student to develop a sense of agency as they take ownership and control of their learning.¹² In addition, blended learning can promote collaboration and enhanced communication as part of an inquiry-based curriculum.¹³ Blended learning therefore creates new possibilities for the development of transformative learning environments that can facilitate the development of critical thinking skills and communities of inquiry,⁸ all of which may have important implications for health professions education.

These kinds of technology-enhanced courses may provide an integrated online and face-to-face learning environment in which health professional students are able to develop the relevant 21st century skills that will enable them to thrive in increasingly complex health systems. However, educators often make assumptions about students' use of technology, thinking that frequent use of social media is associated with a proficiency in the use of emerging technology for enhanced learning. One implication of the challenges inherent in a curriculum transformation aimed at increased international collaboration and more effective uses of information, is that students will need the knowledge and skills to use emerging technologies as part of their learning practice. This digital literacy should be conceived as more than simply developing a set of operational skills aimed at enhanced information retrieval, but rather an approach to learning that incorporates an understanding of the social and cultural influences of emerging technologies on higher education. In other words, it is not enough that students use technology more efficiently, but that their use is informed by information evaluation, analysis and synthesis. To be digitally literate is therefore an extension of knowledge and skills beyond simple operational ability, and into a domain of conceptual ability where students are able to match the digital medium to their relevant learning objectives.¹⁴

As higher education institutions increasingly move parts of their curricula into online and blended courses, care must be taken to ensure that students will be able to use technology as part of their learning objectives. In order to inform the design of an international blended learning course in physiotherapy ethics, the authors aimed to determine the level of technology use and access among students from physiotherapy departments at universities in seven countries (Bangladesh, Belgium, Brazil, Luxembourg, South Africa, Sudan, and Switzerland). These students would all be engaging in the blended course in professional ethics. This paper therefore presents the findings from an international survey of technology use and access among physiotherapy students at seven institutions, and discusses the relevance of those findings for educators interested in developing blended or online courses in health professions education.

2. Methods

This paper reports the findings from a descriptive survey conducted among physiotherapy students in a variety of countries. This descriptive design was

chosen, as there is limited evidence on the levels of technology use and access or digital literacy across international boundaries in physiotherapy education. With the increased interest in internationalization of curricula, descriptive studies are important to understand the context in which future studies may take place.¹⁵

2.1. Participants

A questionnaire was administered online via Google Forms to a sample of 802 physiotherapy students from physiotherapy departments in seven countries, and received responses from 373 (response rate = 47%) students of which 258 were female (69%). Most students were between 18 and 20 years old (48%) or between 20 and 25 years old (35%).

2.2. Materials

We modified the Educause Center for Analysis and Research (ECAR) Study of Students and Information Technology,¹⁶ removing some questions that were deemed to be irrelevant for this study (example, questions on wearable technology and student demographics that were specific to a North American context). The modified version of the ECAR used in this study can be accessed online. The questionnaire in this study used specific technologies as proxies for ownership, access and use of technology in general. For example, when a student reports having edited a wiki, we can infer something about their relative level of digital literacy, regardless of whether a blended learning environment includes a wiki or not. Similarly, it makes sense to ask participants if they have used Twitter, rather than if they use microblogging services. The services in themselves are not important, but students' experiences with them allows educators to make choices about what kind of support is necessary.

The modified questionnaire was piloted on two occasions for content validity and test-retest reliability. The survey showed an overall good test-retest reliability with most of the survey items having Kappa values between 0.5 – 0.6 (indicating moderate agreement); 0.7 – 0.8 (indicating strong agreement); or > 0.8 (indicating almost perfect agreement).

2.3. Procedure

The questionnaire was administered online via Google Forms to students from physiotherapy departments in seven countries. Collaborators in these

departments were recruited via personal and professional networks, beginning with the project coordinator (MR). The data gathering process took place over a six-month period in the first half of 2016. The extended period of time was necessary to accommodate institutional delays with respect to getting ethics clearance, and also to increase the sample size.

2.4. Analysis

Data were exported to Microsoft Excel for Mac 2011 and statistical analysis was done using IBM SPSS v23. Chi-Square and Kruskal-Wallis tests were used to look at nominal data and ordinal data respectively of independent samples. This study has received ethics clearance from the University of the Western Cape (registration number: 14/8/2), the University of Antwerp (registration number: B300201524717) and the Ethics Review Committees of the Centre for the Rehabilitation of the Paralysed (CRP), Bangladesh (CRP-R&E-0401-157).

3. Results

The results are presented as discrete items below with each table or figure corresponding to an associated question in the survey.

Table 1 shows that most physiotherapy students of the total sample ($N = 373$) were women (69.2%) and younger than 25 years (82.4%), with significant differences between institutions ($p < 0.001$).

In **Table 2**, it is particularly noteworthy that the vast majority of students in this cohort had never written a blog post (86%), edited a wiki (89%) or subscribed to an RSS feed (92%).

While there was not a gender difference for writing a blog ($p = 0.71$, Chi-Square = 1.36, $df = 3$), editing a wiki ($p = 0.20$, Chi-Square = 4.65, $df = 3$) or following an RSS feed ($p = 0.50$, Chi-Square = 7.81, $df = 3$), there was for using collaborative word processors such as Google Docs ($p = 0.031$, Chi-Square = 10.66, $df = 4$) and using Twitter ($p = 0.014$, Chi-Square = 12.46, $df = 4$).

There were also significant differences between institutions in the use of online tools and services, including writing a blog, editing a wiki, using collaborative word processors such as Google Docs, using Twitter ($p < 0.001$) and following an RSS feed ($p = 0.002$). In this survey, students were asked about their use of specific services. This was not because those services are particularly important for blended learning, but because they are relatively common, and

Table 1
Participating institutions and response rate.

Institution	Sample description	Responses/Potential responders	Gender responders F/M (Total)
Ahfad University for Women (Khartoum, Sudan)	Third year undergraduates	23/23 (100%)	23/0 (23)
Bangladesh Health Professions Institute (Savar Dhaka, Bangladesh)	First year undergraduates	38/39 (97%)	29/9 (38)
Bern University of Applied Sciences – Health (Bern, Switzerland)	Undergraduate	15/104 (14%)	41/11 (52)
	Postgraduate (Masters)	37/113 (33%)	
Lunex (Differdange, Luxembourg)	First year undergraduates	49/52 (94%)	16/33 (49)
University of Antwerp (Antwerp, Belgium)	First year undergraduates	120/290 (41%)	76/44 (120)
Universidade Federal de Minas Gerais (Minas Gerais, Brazil)	Undergraduate students	55/120 (46%)	46/9 (55)
University of the Western Cape (Cape Town, South Africa)	Second year undergraduates	36/61 (59%)	27/9 (36)
Total		373/802 (47%)	258/115 (373)

Table 2

Number of students who have never used the following services. Data is expressed as number of students that answered 'no' and percentages (%). *RSS* = Really Simple Syndication: a web protocol that allows for content to be distributed and subscribed to. *AUW* = Ahfad University for Women; *BHPI* = Bangladesh Health Professions Institute; *BUAS* = Bern University of Applied Sciences; *Lunex* = Lunex University; *UAntwerp* = University of Antwerp; *UFMG* = Universidade Federal de Minas Gerais; *UWC* = University of the Western Cape.

	Google Docs	Twitter	Written a blog	Edited a wiki	RSS
AUW, Sudan (<i>n</i> = 23)	12 (52%)	15 (65%)	20 (87%)	22 (96%)	22 (96%)
BHPI, Bangladesh (<i>n</i> = 38)	38 (100%)	34 (89%)	38 (100%)	38 (100%)	38 (100%)
BUAS, Switzerland (<i>n</i> = 52)	32 (62%)	48 (92%)	47 (90%)	51 (98%)	47 (90%)
Lunex, Luxembourg (<i>n</i> = 49)	21 (43%)	30 (61%)	38 (78%)	42 (86%)	45 (92%)
UAntwerp, Belgium (<i>n</i> = 120)	35 (29%)	60 (50%)	109 (91%)	109 (91%)	112 (93%)
UFMG, Brazil (<i>n</i> = 55)	6 (11%)	31 (56%)	36 (65%)	36 (65%)	47 (85%)
UWC, South Africa (<i>n</i> = 36)	22 (61%)	13 (36%)	33 (92%)	34 (94%)	34 (94%)
Total sample (<i>n</i> = 373)	166 (45%)	231 (62%)	321 (86%)	332 (89%)	345 (92%)

the skills necessary to use them are reasonable indicators of more general tasks that students might be expected to use in a blended learning course.

While 87% of the respondents indicated that they had never taken a MOOC (Massive Open Online Course) and did not know what it was, only 2% reported having completed one.

Table 3 demonstrates that most students (67%) report a preference for at least some online components in their professional programs, while very few (6%) believe that a completely online course is appropriate.

There was no significant difference between female and male students ($p = 0.637$) but there was a significant difference between institutions ($p < 0.001$).

It is very clear from Fig. 1 that students in this study regard their laptops and mobile phones as being the most important devices for learning, with more than 60% of students reporting that tablets are not or not very important. Almost 80% of respondents reported that desktop computers are also not at all to just moderately important for their learning. There was a significant difference in the perceived importance of

Table 3

Student preferences for online learning. Data is expressed as number of students and percentages (%). AUW = Ahfad University for Women; BHPI = Bangladesh Health Professions Institute; BUAS = Bern University of Applied Sciences; Lunex = Lunex University; UAntwerp = University of Antwerp; UFMG = Universidade Federal de Minas Gerais; UWC = University of the Western Cape.

	No preference	No online components	Some online components	Completely online
AUW, Sudan (n = 23)	8 35%	7 30%	8 35%	0 0%
BHPI, Bangladesh (n = 38)	0 0%	0 0%	38 100%	0 0%
BUAS, Switzerland (n = 52)	6 12%	2 4%	38 73%	6 12%
Lunex, Luxembourg (n = 49)	15 31%	7 14%	24 49%	3 6%
UAntwerp, Belgium (n = 120)	14 12%	24 20%	74 62%	8 7%
UFMG, Brazil (n = 55)	3 6%	5 9%	46 84%	1 2%
UWC, South Africa (n = 36)	7 19%	5 14%	20 56%	4 11%
Total sample (n = 373)	53 14%	50 13%	248 67%	22 6%

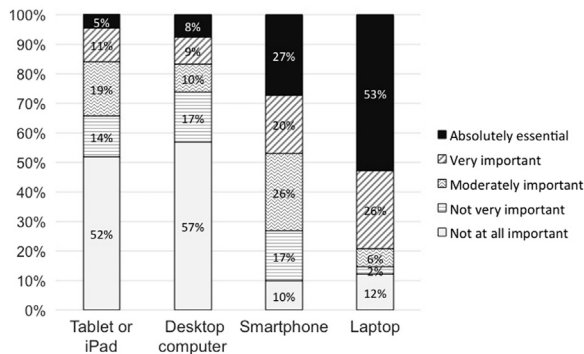


Fig. 1. How important is each device to your academic success?

devices for academic success between institutions (desktop computer, laptop, tablet and smartphone, $p < 0.001$) and gender (desktop computer, $p = 0.031$; tablet, $p = 0.030$ and smartphone, $p = 0.007$).

In the total sample 93% of the students owned a smartphone, 80% a laptop, 40% a tablet and only 33% owned a desktop computer. There was a significant difference in ownership of devices between institutions for laptop, tablet and desktop computers ($p < 0.001$), but not for smartphones ($p = 0.058$).

Not surprisingly, the majority (70%) of the students indicated that they use their smartphones as the primary device for connecting to the Internet, followed by a laptop (23%), a tablet (4%) and a desktop computer (3%).

Fig. 2 illustrates how often physiotherapy students from different institutions are connected to the Internet.

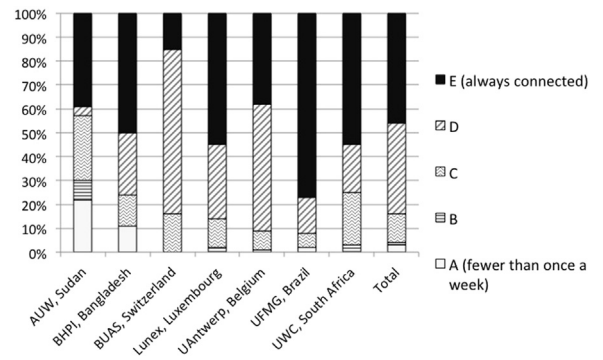


Fig. 2. How often do you use the Internet? Students had to choose between a 5-point Likert scale indicating 1 (fewer than once a week) - 2 - 3 - 4 - 5 (always connected).

There was a significant difference in reported Internet use between different institutions ($p < 0.001$).

In Fig. 3 it is clear that students are most concerned about being able to register and access course information from their devices. Next in importance is the ability to read assigned texts and check grades. It is interesting to note that these are all passive – and mostly administrative – activities that are useful for supporting, but not necessarily driving, learning.

In Fig. 4 students reported that they would like to see an increase in the use of mobile devices, online collaboration, lecture capture, educational games, and the use of external content (defined in the survey as YouTube, Wikipedia, etc.) in their e-learning environment.

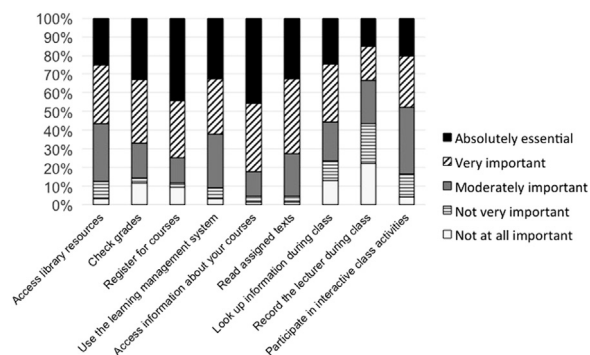


Fig. 3. How important is it for you to be able to do the following academic activities from any of your devices?

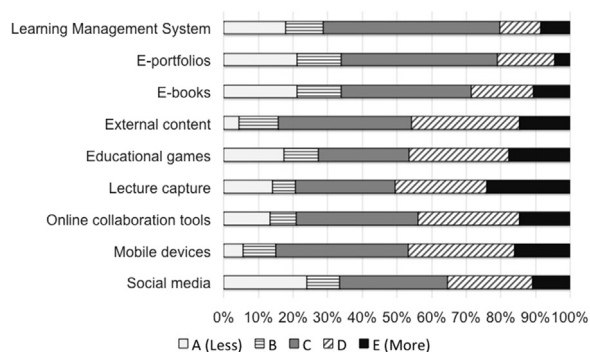


Fig. 4. Which tools or resources do you wish your teachers used less or more?

4. Discussion

The results of this study demonstrate that there is a wide variety in the factors necessary to consider when designing a blended learning module for an international cohort of physiotherapy students. These include device ownership, Internet access, proficiency and experience with online services and tools, and the relatively high value that students place on administrative tasks that are associated with learning. In addition, it is clear from this group of students that they care about more than simply having access to content as part of their learning experience, and that any international blended course would need to take this into account.

Relentless efforts were made to include data of different countries in this study. The response rate for the Bern students was much lower than the other data collection sites and included master's students. In spite of this data limitation, this study succeeded in collecting responses from an international sample of physiotherapy students, which is in keeping with the study aim. An online survey was the only reasonable

option given that participants were distributed across seven countries. However, we should acknowledge the possibility of a bias in the data because of this. There was a wide variety of Internet access between students at different institutions, which may have had implications for the frequency and regularity with which educators can expect students to engage online. Educators wanting to implement blended courses between international departments should therefore pay special attention to the course pacing and structure, acknowledging the challenges that some students may face. It also has implications for the design of courses that should include the ability to download resources for offline access, especially in cases where students have limited access to the Internet. Physiotherapy educators cannot make assumptions about students' access to online resources and must design around this limitation.

In this study most students reported owning a smartphone (93%), while only 40% owned a tablet, which is very similar to other findings in higher education reporting that more than 91% of respondents owned a small mobile device but only 37% owned a tablet.¹⁷ If students are only expected to use their device to consume content (for example, reading text and watching video) then this may not be significant. However, if educators expect students to create through writing activities, then it seems reasonable to expect students to work on less portable devices, like laptops. Indeed, the majority of students in this study (53%) indicated that a laptop was either absolutely essential or very important for their academic success, followed by a smartphone (27%). While the educational literature has emphasized the importance of mobile technologies in 21st century higher education¹⁸ it may be that the use of mobile devices is relevant in specific contexts, and should not be regarded as an inherent good.

A smartphone was the device that was primarily used to connect to the Internet, which is an indication that online courses and content should be suitable for small screens. Moreover, only a minority of students owned a tablet and only 16% considered that tablets were absolutely essential or very important for their academic success. These results do not strongly encourage the use of tablets for e-learning, which makes sense in the context of online courses that require students to be actively engaged in tasks that require writing and other forms of content creation.¹⁹ However, it is also important to note that activities for which mobile devices are important often include those that take location context into account. For example, workplace-based learning activities increasingly rely on

students having mobile devices.²⁰ Educators interested in designing blended learning environments should therefore assume that students will access different aspects of the course from smartphones and laptops, which means that the learning environment must incorporate responsive design elements i.e. the content should adapt according to the screen size of the device it is accessed with.

Blended learning environments that integrate features of 21st century learning contexts would typically include activities like collaborative authoring of documents (for example, using a service like Google Docs or wikis), writing blog posts, micro-blogging in the form of status updates (for example, Twitter), and subscription to newsfeeds to follow other course participants (for example, using RSS).¹⁹ This study has shown that the large majority of physiotherapy students from a several departments around the world have limited experiences with the use of these tools, even though there is evidence that they can be used to develop a variety of graduate attributes in an authentic learning environment.^{13,21} When initial support is provided, students are able to make effective use of these technologies to enhance their learning. It may be then, that physiotherapy lecturers in these departments are generally reluctant to introduce these tools into their teaching practices. In addition, the relatively high percentage of students who had never used Twitter (62%) is in contrast to the perception that Twitter is the newsfeed of the web.²² However, it should be noted that Twitter is useful to consider because it can be used to filter “academic” information coming to students via a feed, while Instagram and Snapchat (as examples) are mainly used for sending images to friends i.e. the “academic” use case is extremely limited. There is little value in this paper in discussing services that are popular but unlikely to be used for learning. Nevertheless, there is evidence that the use of Twitter arguably can promote communication among students and learning among peers, and that it can facilitate teaching and learning and professional development, even in developing countries.^{23,24} In this context it is important to recognize that educators cannot assume that students have an understanding of technology for learning, and that some time must be spent helping prepare students to make effective use of whatever technology is included in the learning environment.

Today, most schools that use e-learning rely on learning management systems (LMS) that enhance student administration, content storage and dissemination, assessment submission and feedback, record keeping, grading and student tracking.²⁵ It is interesting

to note that, while many educators think of the LMS as the centerpiece of their technology integration, this – in addition to e-portfolios and e-books – were the components of this study that students were most ambivalent about. What was also surprising was the relatively high number of students who reported wanting less social media in their learning.

It is unclear why the students in this study were asking for less social media in their learning environment, but it is an important point to consider when deciding if a blended learning course should incorporate social media elements as part of the communication channel. However, considering that most students in this survey reported a desire to increase the use of technology for administrative learning tasks, it may be that students do not associate technology with learning per se, but rather for the administration of tasks that support learning. In addition, this survey did not make any attempt to evaluate actual technology use in these departments, so it may be that these uses of technology simply reflect what lecturers ask students to do.

The integration of technology in higher education is effective to a modest but significant degree, as Bernard et al. have put it cautiously.⁹ Liu et al. (2016) came to a similar conclusion about blended learning, but more specific with regards to knowledge acquisition in health professions.¹⁰ A large majority of physiotherapy students surveyed in our study reported a preference for the integration of at least some online components in their current programs. This general preference for increased use of technology is important to acknowledge, since even in institutions where Internet access is a challenge, a majority of students reported a desire to increase the use of technology in some form. This presents a challenge for educators who wish to integrate their use of technology in the classroom because this will inevitably require an associated increase in student support to prepare them to use these services effectively as part of their learning. From a pedagogical point of view this seems reasonable, especially in the physiotherapy educational program, where a purely online program would present significant operational challenges. In addition, it serves as a reminder to those who might believe that today's students want all of their learning to be online. It may be that an approach to learning that blends different components of online and face-to-face contexts is the most appropriate format for educators interested in integrating digital elements into their traditional curricula.¹³

It seems clear then, that a blended course for this group of students would need to ensure that significant effort was put into first preparing students with the

underlying rationale and support necessary to engage in open online spaces. Open online courses call for increased student engagement, self-directed learning and critical ways of being that students only familiar with traditional approaches may not be comfortable with.²¹ The relatively low value that participants in this study placed on the use of the institutional learning management system should give us pause for thought. Educators have a tendency to place the LMS at the center of any online or blended learning experience, despite its significant shortcomings with respect to driving student learning.²⁶ Lecturers who intend on introducing technology into the classroom should be aware that students might have a preference for more innovative uses of technology for their learning.

Students' desire for an increased use of external content presents valuable opportunities for educators with an open mind who are looking to expand their teaching and assessment practices. For example, the use of open access resources like Physiopedia can help students develop their content knowledge while also improving their research skills if they are encouraged to improve the resource. From this perspective, students might be more prepared for open online environments than it initially appeared, considering their ambivalence towards highly structured learning environments like the LMS, and their calls for an increase in the use of external online content.

5. Conclusion

Students in this survey reported what they use technology for with respect to their learning, and also what they want from technology. It is incumbent on health professions educators to use this information to inform the design of online and blended learning environments. Differences in baseline ownership, access and use of technology across international boundaries highlight the possible challenges inherent in the design and implementation of distributed online and blended learning courses among health professions students. Educators often make assumptions about students' use of technology, especially when they confuse the social use of technology with the pedagogical use of technology. This study has shown that students in different geographical contexts have different levels of digital literacies, defined by their use of devices, access to technology, and experiences with a variety of online tools and services. These all influence students' ability to engage effectively in online or blended learning environments. There was a strong indication among this sample that students

would prefer an increase in the use of digital tools in their learning, with suggestions for specific changes in practice being made. Future research in this area could include surveys of actual technology use across a variety of learning contexts, as well as investigations of how lecturers make choices in the design of online and blended learning environments. Health professions educators who wish to make use of online or blended learning environments must be cognizant of the fact that students in different countries have different levels of ownership, access and use of technology, and that decisions around course design must therefore be made with caution.

Acknowledgements

The authors gratefully acknowledge the cooperation of all students and institutions that participated in the study. They would like to thank in particular Jan Cabri of Lunex University in Luxembourg, Ana Maria Chagas Sette Câmara of the Departamento de Fisioterapia, Universidade Federal de Minas Gerais, Minas Gerais in Brazil and Reham Altigani of the Ahfad University for Women, Khartoum in Sudan for their help with collecting the data.

Funding acknowledgements

Michael Rowe receives funding from the South African National Research Foundation.

Authors' contributions

All authors helped with the conception and design of the work, the data collection, drafting the article and critical revision of the article. D. Vissers performed the data analysis and interpretation. All authors gave their final approval of the version to be published.

Declaration of interest

The authors have no declarations of interest to report.

Appendix A. Supplementary material

Supplementary data associated with this article can be found in the online version at <https://doi.org/10.1016/j.hpe.2017.12.003>.

References

1. Frenk J, Chen L, Bhutta, ZA, et al. Health professionals for a new century: transforming education to strengthen health systems in an interdependent world. *Lancet*. 2010;376(9756):1923–1958.
2. Bleakley A. Blunting Occam's razor: aligning medical education with studies of complexity. *J Eval Clin Pract*. 2010;16(4):849–855.
3. WHO. *Transforming and Scaling Up Health Professionals' Education and Training: WHO Education Guidelines*. November 2013; 2013.
4. Altbach PG, Reisberg L, Rumbley LE. *Trends in Global Higher Education: Tracking an Academic Revolution*; 2009.
5. Gemmill I, Harrison R, Clegg J, Reed K. Internationalisation in online distance learning postgraduate education: a case study on student views on learning alongside students from other countries. *Innov Educ Teach Int* 2015;52(2):137–147.
6. Leask B, Carroll J. Moving beyond 'wishing and hoping': internationalisation and student experiences of inclusion and engagement. *High Educ Res Dev* 2011;30(5):647–659.
7. Sanderson G. Internationalisation and teaching in higher education. *High Educ Res Dev* 2011;30(5):661–676.
8. Garrison DR, Kanuka H. Blended learning: uncovering its transformative potential in higher education. *Internet High Educ* 2004;7(2):95–105.
9. Bernard RM, Borokhovski E, F. Schmid R, M. Tamim R, Abrami PC. A meta-analysis of blended learning and technology use in higher education: from the general to the applied. *J Comput High Educ* 2014;26(1):87–122.
10. Liu Q, Peng W, Zhang F, Hu R, Li Y, Yan W. The effectiveness of blended learning in health professions: systematic review and meta-analysis. *J Med Internet Res* 2016;18(1):e2.
11. Rowe M, Frantz J, Bozalek V. The role of blended learning in the clinical education of healthcare students: a systematic review. *Med Teach* 2012;34(4):e216–e221.
12. Giroux H. *On Critical Pedagogy*. The Tower Building, 11 York Road, London SE1 7NX.: The Continuum International Publishing Group Ltd.; 2011.
13. Rowe M, Bozalek V, Frantz J. Using Google Drive to facilitate a blended approach to authentic learning. *Br J Educ Technol* 2013;44(4):594–606.
14. Lankshear C, Knobel M. *Digital Literacies: Concepts, Policies and Practices*. New York, NY 10006: Peter Lang; 2008.
15. Creswell JW. *Research Design Qualitative, Quantitative, and Mixed Approaches*. 1 Oliver's Yard 55 City Road London EC1 Y 1SP United Kingdom: SAGE Publications Ltd.; 2009.
16. Dahlstrom E, Brooks CD, Grajek S, Reeves J. *ECAR Study of Students and Information Technology*. Louisville, CO: ECAR; 2015.
17. Chen B, deNoyelles A Exploring Students' Mobile Learning Practices in Higher Education. *EDUCAUSE Review*. 2013. (<http://er.educause.edu/articles/2013/10/exploring-students-mobile-learning-practices-in-higher-education>).
18. Ally M, Tsinakos A. *Perspectives on Open and Distance Learning: Increasing Access Through Mobile Learning*. Vancouver, British Columbia, Canada: Commonwealth of Learning; 2014.
19. Herrington J, Reeves T, Oliver R. *A Guide to Authentic e-learning*. New York, NY, USA: Routledge; 2010.
20. Narayan V. Herrington JpASfCiLiTE. *Towards a theoretical mobile heutagogy framework. Ascilite 2014: Rhetoric and Reality. Critical Perspectives on Educational Technology*; 23 - 26 November 2014; Dunedin, New Zealand; 2014.
21. Rowe M. Developing graduate attributes in an open online course. *Br J Educ Technol* 2016;47(5):873–882.
22. Kassens-Noor E. Twitter as a teaching practice to enhance active and informal learning in higher education: the case of sustainable tweets. *Act Learn High Educ* 2012;13(1):9–21.
23. Chawinga WD. Teaching and learning 24/7 using Twitter in a university classroom: experiences from a developing country. *E-Learn Digit Media* 2016.
24. Tunnecliff BJ, Ilic D, Morgan, P, et al. *The Acceptability Among Health Researchers and Clinicians of Social Media to Translate Research Evidence to Clinical Practice: mixed-methods Survey and Interview Study. Journal of medical Internet research*, 17; 2015. [1-1].
25. Sclater N. Web 2.0, Personal Learning Environments, and the Future of Learning Management Systems. *ECAR Res Bull* 2008;2008(13).
26. Wilson S, Liber O, Johnson M, Beauvoir P, Sharples P, Milligan C. Personal Learning Environments: challenging the dominant design of educational systems. *J e-Learn Knowl Soc* 2007;3(2):27–38.