Preparing Globally Work Ready Allied Health Care Graduates: Technology as a Useful Teaching Tool for Allied Health Educators

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Abstract
Global education requires collaborative, standardized and flexible teaching pedagogies which are fit for purpose to each local community and diverse range of changing student population across institutions. Educational initiatives and use of technology are essential to train self-directed lifelong learners with transferrable skills preparing graduates for technical, professional, entrepreneurial and multinational leadership roles in future. The emerging economies are based on knowledge as a key factor of production, and industries demand highly trained employees in the fast changing health industry. To address diverse needs of students, mixed mode innovative strategies need to be used to train globally work ready allied health care graduates with modern day employability attributes including good soft and human skills by incorporating flexible learning tools and technology. Our teaching strategies, resulting in very high employment rate before graduation with global employers and low attrition rate, include work integrated learning, problem based learning, inter professional learning, team work with group discussions leading to peer review, reflective practice, self-directed learning and various means of formative and summative assessment items. This is incorporated within horizontal and vertical scaffolding of teaching material across courses and subjects to prepare interdisciplinary graduates for very liquid workplace of the world today. This article will introduce some of the above mentioned strategies employed and successfully achieved by our degree programs across allied health. However, our challenges remain in evaluation of effectiveness and incorporation of entrepreneurship for increasing healthcare students aspiring to be self-employed innovators in the international healthcare industry.

Keywords: Higher education, globalization, innovative mixed mode curriculum, work ready graduates, allied health care students, learning and teaching strategies, teaching pedagogy, graduate employability skills, work integrated learning, problem based learning, multidisciplinary inter professional learning

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Introduction

It is important for academics and teaching team in higher education to understand their students' background and diversity in order to provide them with tools and support that will allow them to positively engage with learning that matches their individual needs and to reach the best possible outcome of becoming high achieving graduates. The students and graduates need to be equipped with skills that make them lifelong learners without focusing mainly on the exams and grades. Understanding the students' needs and capacity as well as appreciating their diverse backgrounds, teachers can accommodate the diversity of students and provide an avenue for better ways of belonging in their institution (Thomas, 2012). This has been shown that student's success at university may be reliant on their feeling of belonging at the university. Often institutions expect students to adapt to their teaching environment however it improves student learning and is becoming a common theme in higher education sector to provide students flexibility and teaching team work together with student body in collaborative manner in the teaching and learning pedagogy.

Purpose built different types of summative and formative assessments must be included to promote deeper understanding of concepts as part of various approaches to learning (Postareff *et al*., 2007).

Considering the diversity and needs of students, standardization of disciplinary higher education globally and preparing work ready graduates for emerging economic global market is the aim of higher education institutions, this article will introduce some of the strategies employed and successfully achieved by our degree programs across allied health.

Training future allied healthcare workforce is a collaborative responsibility of both the higher education institutions and the health care industry. Universities role is to develop an innovative, student centered learning and teaching culture by establishing the strategies recognizing the ways how technology can improve students experience both inside and outside the classrooms. It is vital for institutions to better engage with industry (end product user) to ensure they get the workforce which requires minimal on job training and besides having academic up-to-date knowledge and technical skills, our graduates also have soft human skills to succeed in the future world of workforce. It is imperative that higher education prepares graduates for the global automated industry of future (Talley, 2017) by maintaining open communication and involvement with industry, policy makers and decision makers as well as regularly including technology in teaching.

Technology in Teaching

With fast changing health care system there has also been a steady rise in the use of technology for learning and teaching over last three decades as an approach to educating allied health students. Multiple newer platforms and software have made the delivery of learning resources more cost effective and productive.

Today university students come from a diverse range of backgrounds with varying capacity for learning. They all need to be supported to succeed equitably and to maintain a high retention rate (Thomas, 2002).

Minicomputer and personal digital assistants (PDA) have been commonly used in health care setting for few years now however only recently have they been incorporated in tertiary teaching institutes particularly in allied health care teaching class. The PDA's provide a fast reference to material useful in educational or clinical situations (Long *et al.,* 2016). They have also been used as tools for clinical education by helping calculate clinical prediction rules or providing information related to adverse effects of drugs (Day-Black & Merrill, 2015). However with widespread use of smartphones and ever increasing applications being developed for these devices (Chen, Lieffers, Bauman, Hanning, & Allman-Farinelli, 2017), many of the PDAa for the delivery of educational and clinical applications have become outdated. The mobile computing through smart phones has opened another avenue of teaching accessibility regardless of where students and teachers are located around the world or what device they are using. This has been achieved through the creation of browser-based software that is device-independent.

There are multiple types of mobile devices that students can use to access the internet. Mobile computing, and the use of the network-capable devices, such as RPi, is being established and used by students on many high school campuses. As it is a relatively new technology being introduced in university teaching some challenges still remain, specifically with notions of privacy, control of access, cheating on assessment items and copying of information. However, the ever expanding array of applications and software, the use of technology for educational purposes is only limited by our inventiveness.

Work Integrated Learning (WIL)

Industry experience in form of clinical placements has been core part of learning in allied health tertiary education. However, limited time exposure and financial burden on the tertiary teaching institutions sometimes limits full benefit that can be attained by industry placement. One of the means of engaging students in their own learning is to take the class room to the students (Montreux, *et al.,* 2015) to enhance flexible learning using work integrated learning and technology. One of the applications of the use of technology in diagnostic health care is reviewing blood and tissue stained films to understand and report on the morphology of the cells and tissue in making clinical diagnostic decision. It is very time intensive skill that requires more hours of practice than is usually possible in the classroom microscopy. Our students use a free downloadable program called Aperio, which makes microscopic images of all blood cells and body tissue sections reviewed under microscope in classroom available to be examined on a home laptop or even a smartphone at any time. We also supplement the samples with annotation information as a means aiding continuing learning.

Since the implementation of this highly popular program, student grades and satisfaction have improved significantly. We use WIL to integrate the acquisition of disciplinary heavy content and skills with their application in workplaces. I motivate my students by relating the theoretical knowledge from interactive lectures with corresponding laboratory exercises within the same week, simulating actual activities that they will undertake in their daily work life.

We also use virtual reality (VR), an interactive 3 dimensional (3D) computer-generated teaching tool that uses computer graphics merging several display and

interface devices to provide the effect of student engagement (Pan, Cheok, Yang, Zhu, & Shi, 2006). Virtual reality includes real world elements into a simulated environment. The 3D environment has been used to animate motion data for biomechanics teaching (Dixon, Loh, Michaud-Paquette, & Pearsall, 2017). This technology allows students' access to real world laboratories and activities not normally accessible due to safety issues or financial feasibility in a teaching class.

Problem Based Learning (PBL)

The evolving global health industry requires a multi-skilled workforce capable of applying and translating their knowledge and competencies such as communication skills, leadership, and empathy as well as team work (Beck & Laudicina, 1999) in multiple contexts and working across multiple disciplines. A PBL approach has been shown to lead to the development of self-directed learning skills and enhance student-centered learning outcomes beyond knowledge acquisition (Setia, 2010).

In this approach, we provide real scenarios from local hospiatl laboratories and from our professional experiences, to stimulate the problem solving and troubleshooting, and to support students to solve problems commonly encountered, but that are not typically found within the textbook. We engage students in these patient case studies and PBL activities over several weeks in the laboratory, linking various topics. These are simulation of real life cases where students apply knowledge across the semesters and within a semester across the weeks and across the disciplines within the same semester. Students need to apply the cross disciplinary knowledge to reach the final diagnosis. We link the interactive lectures with the corresponding PBL exercises within the same week.

Interprofessional Learning (IPL)

Allied healthcare professionals are an integral part of multidisciplinary healthcare teams requiring highly skilled and competent members from every health discipline. Health Professionals work in teams to manage patients, for this collaboration, facilities are required for meeting either face to face or using technology. In the university students are provided IPL experience in form of an opportunity to work with and from other medical or allied health fields to discuss cases and solutions to medical problems as a result developing the communication skills essential for their employability.

Video-conferencing has been in use since the 1980s. However, development of web conferencing experiences for learning is gaining popularity as o online forums for collaborations. Our university similar to many others uses the browser-based web conferencing package Blackboard Collaborate that allows simultaneous collaboration no matter where the students or staff is located. Social media also covers a wide range of platforms under university control being used in higher education sector, including blogs, wikis, YouTube videos, Twitter, Skype and closed Facebook pages (Orr, Baram-Tsabari, & Landsman, 2016; Zitzelsberger, Campbell, Service, & Sanchez, 2015). These applications have made IPL easily accessible across borders permitting the exchange of user-generated content to share, distribute and discuss the knowledge gained in virtual communities and networks.

E-portfolios and Reflective Practice

Industrial automation has had a global impact on clinical laboratories and biopharmaceutical Science. Total laboratory automation (TLA) and innovative information software has changed the working environment for scientists as well as the way students are being trained and educated (Sédille-Mostafaie, Engler, Lutz, & Korte, 2013). The Radloff and Coates (2009) Student Engagement Questionnaire (SEQ) highlighted five new items to measure the areas, in which students were considered as career ready, one of these items included whether students have an up-to date resume (Radloff & Coates, 2009). The electronic based portfolio is a recording of various skills and techniques that a student has accumulated not only during his time in the university but also after graduation. E-portfolio has developed as an effective alternative that may soon replace the traditional paper based resume.

E-portfolios controlled by students for sharing certain folders with the academic supervisors and the industry supervisors. This will allow us to see in real time the progress of the students and we can provide them with real time feedback and guidance instead of waiting till the end and giving them final grades only. This will also be a platform for 3 way communication across the university, industry and students to monitor student progress with ongoing support during the program. These portfolios can be carried by student across all years of their study and they can use them to compile all their work in various courses in different disciplines completed during their university studies. Instead of carrying multiple folders with them to the clinical placement and job interviews, they can have all the material in one e-portfolio for future reference as well as an evidence of their competencies endorsed by academics and industry supervisors when they are ready to apply for jobs in workforce. With e-portfolio, students have the access that they control and can share files/folders with their academic supervisors as well as industry supervisors when on clinical placement.

This allows students to have all their study material across the courses in one single portfolio and allows the supervisors to monitor their progress in real time to provide timely comments and feedback particularly in various courses where they have to keep weekly reflective journal as part of their main assessment of the courses. Any work done by students in the classroom or reflections involving critical learning and peer reviewing can be saved on their e-portfolio directly or through their USB. It is very useful to have a user friendly system where students can save their reports and tissue/blood slides features to take with them to clinical placement and job interviews upon graduation, with their supervisors comments/feedback and endorsement of having met competencies.

Reese and Levy (2009) regard the implementation of e-portfolios to be advantageous in documenting real world learning experiences where each student is accountable for their own education. We get the students to use Pebble Pad to record their assessments and self-reflections in their individualized e-portfolios. Pebble pad is a personalized learning and assessment system used in many tertiary institutional courses to enhance student-learning experiences providing a lifelong holistic learning experience. Application of Pebble Pad allows the student to present a timeline showcasing self-reflections, accumulation of resources and competent training skills, which helps the students to create a resume which can be updated in real-time

throughout their student life. Furthermore, Pebble Pad acts an effective medium to allow individuals from the industry, usually future employers, to be able to access the training modules completed by the student, and in turn positively influence the employability of a student.

Integration of e-leaning technologies within the programs associated with Health Science. However, these technologies are still in their early stages of development and require significant contributions from the industry and academic staff for further development.

Assessments

Besides various teaching strategies, different modes of ongoing formative and summative assessments (Harlen, 1997) are also used to help students improve their learning through constant feedback provided both in class and online individually. Our program has a high number of students from some of the groups that Universities generally deem to need greater support including mature age students, those from lower socio-economic backgrounds, first-in-family to go to University, and a range of multicultural non-English speaking background, indigenous and disability groups. To meet the wide range of needs presented by this diverse student population, we ensure that our courses offer a range of assessment techniques to encompass students with varying learning capacity and styles (Thoams R Gusky, 2003). All our course conveners plan assessments in consultation with the whole team and develop templates, as well as marking rubrics, which are scaffolded across courses. Each mid-trimester and final exam include multiple choice questions, short answer, essay questions as well as a case study for patient diagnosis based on the results obtained by the student during a practical exam. Students are also required to interpret more complex test results provided from a case study in a theory exam.

Conclusions

Health care workers and therefore educators are under pressure to increase output with in limited resources. There is a need Need to optimise the effectiveness and efficiency of the way students develop their professional skills within limited resources. Innovations in Technology are opening gates for its use as and where possible. The rise of Health Care Technologies in practice means changing face of education from basic theoretical and competency skills to work ready biotech competent allied health practitioners. Technology tools support communication and decision-making. Information systems connect allied health carers to physicians and sometimes patients directly. There is a big need and move to incorporate technology in classrooms for teaching and learning.

Digital technologies are integral component of the allied health care curricula. Education is undergoing a significant shift, moving away from teacher led classroom to student centred approaches (Ramsden, 2003). Current students have been technically savvy from young age that has influenced their learning styles. They require educational resources that engage them in the learning process (Prensky, 2009), and expect technology integrated into their learning experiences (Berman, Fall, Maloney, & Devine, 2008).

While e-learning tool are attractive, sometimes they can have limited educational benefit when designed with no focus on teaching and learning pedagogy. Pedagogical knowledge combines cognitive, social and developmental theories of learning and how they are applied to students in the classroom (Harris, Mishra, & Koehler, 2009). An understanding as to how students learn and transform information into knowledge is important. Students learn most effectively when they can see, hear and interact with the teaching tools.

The technology adoption should be "grounded in the reality that technology alone cannot cultivate education transformation; better pedagogies and more inclusive education models are vital solutions, while digital tools and platforms are enablers and accelerators." (Adams Becker et al., 2017, p. 6). One of the major challenges is to keep updated in the curriculum, the fast changing technology in competitive market. In conclusion, it is fair to say educational technology has been around for decades. However, integrating it into curriculum of allied health care education is a recent fragmented attempt by various organizations globally. It seems essential to use educational technology but with care to ensure it is fit for your purpose and has long term adaptability at minimal ongoing cost.

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