

Digitization of Medical Education

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Introduction

This research paper focuses on the digitization of medical education, proposing that the College of Medicine and Health Sciences at Sultan Qaboos University Oman transition from a paper to digital system. The transition at Sultan Qaboos University Oman exemplifies how a curriculum delivery process can be improved by the implementation of a paperless system. This research seeks to identify, expose, and promote the most efficient methods of digitization in academic administrative environments.

Background

The College of Medicine and Health Sciences (COMHSc) was one of the first state-sponsored colleges to be established in Oman when the university began accepting admissions in 1986. It has an annual intake of 120 to 130 students in the M.D. program (Albarwani, Al-Saadoon, Al-Rawas, Al-Yaarubi, Al-Abri, Al-Lamki, & Tanira, 2014). The total number of staff employed at COMHSc stands at 490, consisting of 75 academics, 325 clinical tutors, 41 administrative staff, and 49 technical staff. In liaison with the university hospital, the college consists of 19 clinical departments and supportive units such as the Administration Office, Medical Education Unit (MEU), and the Examinations Office. The Administration Office is responsible for all non-clinical matters of the employees of the college. The MEU provides the information technology (IT) support for the college to conduct online examinations as well as technical support of all the computer labs. It is actively involved in organizing workshops for assessments as well as staff development in the IT field. MEU is also responsible for providing support in curriculum development, assessment, and updates for teaching and learning.

The Examinations Office is a reference point for all matters related to evaluation. These functions include booking rooms, photocopying of examinations papers, marking the

examinations using Scantron for the multiple choice questions, and entering the marks manually in the computer. The office is in charge of all the college examinations, and workers are routinely required to photocopy approximately 30-page exam papers for approximately 130 students. In the M.D. program, there are courses for the different departmental specialties. The clinical departments' examinations include Pre-clerkship, Junior Clerkship, Senior Clerkship and Final MD comprehensive evaluation. Basic Science examinations are the Phase I and Phase II examinations prior to clinical instruction. All examinations are currently administered on paper (Albarwani et al, 2014).

Statement of Problem

The current medical education system requires extensive resources, specifically time, money, and space. Students' handouts and assessments are all printed out on paper. Lectures are taught using PowerPoint presentations prepared by the instructor, and students are given paper copies of the presentation at the end of the lecture. Students can only access course materials by attending class in person. No videotaping nor online information is otherwise available. This is a problem because not all students are able to attend class due to various reasons, such as illness and personal conflicts.

Class schedules and assessment dates are printed on paper and displayed on the notice board at COMHSc. Communicating with students is done on paper exclusively. Grades are posted on paper grade sheets in the Examinations Office. Much of the curricular content comes from textbooks and photocopied lecture notes. Access to and accumulation of this critical content is challenging for students to manage in this hard copy, printed format.

Significant physical space is required to store course materials and examination papers. The Examinations Office contains files dating back to 1994, although retention requirements are

only for four years. Filing cabinets and shelf space are required because there is an overabundance of paper in the office. Staff cannot utilize the office as a workspace because of these paper files. Switching to online examinations would help significantly to reduce this problem by eliminating the need for such excessive amounts of paper records in storage for archiving purposes.

Going paperless will not only save space, but will also reduce costs. Recent findings by Whistler (2010) indicated that the total printing cost of exam materials by one professor was \$126.72 for a semester. The author observed 14 such professors during a semester at Valdosta State University and found that the cost incurred in one semester totaled \$1,774.08. The estimated cost of printing for one department was \$11,000 per semester (Whistler, 2010). There are currently 75 faculty involved in teaching at COMHSc. If all 75 professors are incurring Whistler's estimated cost of printing, the college is spending an estimated \$9,504 per semester. This is the cost of printing without other expenses such as servicing the photocopiers, purchasing toner, and importing textbooks for medical students. The shift in digitizing medical education could dramatically reduce this cost.

Support for Digitization

Students are attuned to the use of digital technology. Those students who cannot come to campus to submit their assignments can do so electronically from home through an electronic learning management system. The use of mobile devices such as smart phones and iPads should be promoted in the classroom as part of the Bring Your Own Device (BYOD) model. Additionally, students could access course materials in an e-book format (Whistler, 2010).

According to Allen (2014), going paperless has reduced 75% of the filing cabinets in the office examined in his research, and this resulted in the decrease of rented office space and the

associated cost for storing the filing cabinets. Going paperless not only saves space but is also very efficient in searching for documents compared to manual filing. In paper filing, a misplaced document may be more difficult to find, whereas a misfiled electronic document may be more easily retrieved by using search features on the computer. The PDF format for electronic files is useful because it is a universal file type and can be easily transferred to iPads and computers. PDF reader software is open-source and can be downloaded for free on any computer. In order to increase security, PDF files should be encrypted with strong passwords (Allen, 2014).

Clinical teaching may be enhanced by use of an electronic health record (EHR) that doctors are able to access patients' records remotely. Physicians have the ability to log into the EHR system prior to the patient's appointment and view the full record which may help the doctor make better decisions based on a review of the patient's history. An efficient electronic system is helpful in reducing human error compared to paper records (Sokol, 2009).

In the field of education, "e-learning" is gaining popularity as more students register for online classes (Radovic-Markovic, 2010). This type of learning has been made possible by the availability of the wireless Internet. Software such as Blackboard is widely used for conducting "live" classroom sessions electronically. Professors can interact with students in real time by asking questions, holding discussions, and assigning homework. Based on the results of a study by Radovic-Markovic (2010), only 18.7% of all educational institutions in the U.S. do not offer e-learning programs. This study suggests that more than 90% of students are satisfied with e-learning taught by virtual professors because of its flexibility.

According to Radovic-Markovic (2010), Wisconsin-Madison University saved an estimated \$172,000 by implementing an e-learning system resulting in significant monetary savings. In another example, The University of North Carolina-Charlotte has saved

approximately \$5 million by avoiding investment in building construction and opting for online learning. The number of online students has also increased by an average of 25% yearly according to this study (Radovic-Markovic, 2010).

The method of assessing on paper may not provide sufficient information on student performance. It is often difficult to link course content to assessments utilizing paper-based examinations. It requires more people to monitor a paper-based evaluation than a computer-based system. It is also easier to make errors when marking the traditional paper-based assessment and takes workers more time to manually grade the paper exams than digital assessments (Newhouse, 2013).

In an article by Meyer (2008), the use of e-portfolio at Illinois State University was the first step to go paperless in the curriculum. Twenty-six out of 28 students favored the electronic portfolio. The paperless classroom proved to be suitable for most students because it contains up to date grade entry, immediate feedback, and a record that is easily accessed at any time. In this study, students were able to submit their assignments electronically without having to come to class. Meyer (2008) argues that in many universities, technology is not used for teaching and learning as much as it could be. The author emphasizes that instructors should set an example by using technology. By doing so, students will follow the example and use technology themselves (Meyer, 2008).

Hains and Smith (2012) discuss the challenges of implementing a large-scale change in a university environment. In their research, Hains and Smith (2012) evaluate the response of faculty, administration, and students to a transition from an instructor-led pedagogy to one that is learner-centered. He states that instructors are resistant to learner-centered teaching due to using the traditional lecture method for years. It is a challenge to shift to active modalities of teaching

and their concepts about classroom procedures. The administration is also likely to resist change because of the growing demands on faculty research, excess requirements for teachers, and restrictions on university budgets, all of which contribute to an environment that greatly values traditional methods (Hains & Smith, 2012).

It is not only faculty and administrators resisting the change; students may also resist. According to Hains and Smith (2012), students who were taught using the teacher-centered method feel uncomfortable shifting to the new method because it requires them to take more responsibility for their learning (Hains & Smith, 2012). One reason is because teaching from instructor to learner takes less energy and thought from students.

Regardless of the challenges in resisting the change, the benefits outweigh the cost. According to Hains and Smith (2012), gradually introducing changes makes adaptation easier and helps people become more receptive. Therefore, introducing a paperless system more gradually could lead to less resistance.

Case Studies for Digitization

In the article *A Mini Revolution* (Lynn University, 2013), the authors discuss creating the digitalized database at Lynn University in Florida as the school started going paperless in the Fall 2013. Initially they made the decision to move to iPad Minis for all of their courses. The devices changed the way Lynn's faculty delivered their course materials. Students were able to collaborate with their instructor by sharing the iPad screen that was projected for all students to see in the classroom. The instructor was no longer tied up with the screen as he/she could move freely with the iPad while explaining information to the students. Students were more involved during the session by interacting with other students using this technology. The instructor flipped the classroom by having students watch videos at home and come to class prepared for the

lecture. Lynn University made a decision to use iBooks that saved half the cost for purchasing textbooks. In this study, a survey of freshmen was conducted in their first month of using iPad Minis. The majority of students (86.4%) agreed that the devices contributed to their learning while 78.5% believed that technology allowed them better connections with classmates. Sixty-five percent of students favored iBooks over the traditional paper books. This study reveals that 61.1% of students surveyed were influenced to enroll at Lynn University because they were interested in the use of iPad Minis in the curriculum (Lynn University, 2013).

Radford University is another example of an institution that has implemented a paperless curriculum in a Biology class (Smith & Cline, 2011). The university has implemented a Bring Your Own Device (BYOD) program and that is one of the methods for implementing a high-tech learning environment. The most common software used for this Biology class is AOL Instant Messenger, which is a free download from the Internet. Since 95% of students at Radford University were already using AOL Instant Messenger for personal use, it was easy to use the same software for learning purposes. Students have an instant connection to their professors outside the classroom through this software. Students who are unable to attend class inform their professor through AOL. This provides an environment whereby students are free to communicate with instructors virtually rather than face-to-face. The software is helpful in transferring electronic files to the professor without needing to physically come to the university to submit the assignment (Smith & Cline 2011).

Need for Change

In this time of technological change, there is a need to modify the method of teaching and assessment in the College of Medicine and Health Sciences. Students should be engaged in the use of technology to improve their performance by having access to the information before they

attend class. Additionally, faculty should also change the method of teaching to align with the current change in education technology.

Billings (2005) suggests that teachers should shift from teacher-centered classroom to learner-centered teaching. By doing so, students learn by practicing. As technology changes, more and more classrooms are becoming wireless and mobile devices are becoming an integral part of getting information, allowing information to be available anytime and anywhere. Technological devices such as laptops and smartphones are changing the way students learn. Students are always connected and able to constantly learn (Billings, 2005).

According to Newhouse (2013), digital assessment is better than traditional paper assessment because students can be assessed in different ways. These modalities include the use of audio and video recording, screen casting, web cams, and even virtual classrooms for international students or any students who are not able to attend class. The use of such modalities provides more validity and reliability to the assessment.

Assessment is important in terms of measuring whether students have gained knowledge. At COMHSc instructors spend long hours grading examination papers and reading feedback from students on paper. Likewise, students spend extensive time writing examinations on paper then completing the feedback sheets at the end of assessment.

Atkinson and Siew (2013) acknowledged that it is very important for an institution to have a Learning Management System (LMS). Learning Management Systems such as Moodle and Blackboard have the capability of embedding which would improve the process at COMHSc since no rubrics are currently used. This method of assessment lacks the tracking of students' performance and is difficult to measure whether the assessment aligns with the course content. It

is very difficult for students to understand the areas of focus on in order to improve without a rubric. The feedback forms currently in use are not returned to students (Atkinson & Siew 2013).

Atkinson and Siew (2013) state that a well-constructed rubric would provide consistent, fair, and efficient feedback. The feedback would contain criteria that would allow students to improve in their assessments. The feedback would be done frequently during each semester to promote students' improvements and reflect weaknesses and strength of students through different types of assessments. Frequent feedback helps students understand the areas they need more concentration on and therefore improve their learning efficiency. The rubric would be available for students at the outset of the course in order to give students an understanding of course requirements. This approach allows students to plan for their study time more appropriately.

The use of the LMS provides efficiency in marking the assessments as well as a quick response in providing students with feedback. Time is saved and accuracy of assessment is increased. Results provided in this paper suggest that digitization of assessment and student feedback can be used by the Examinations Office to monitor students' progress more effectively and efficiently (Atkinson & Siew 2013).

Conclusion

Multiple arguments presented in this paper support the transition to a paperless system for COMHSc in an incremental approach over time. The benefits of this process include cost savings from reduced printing, less space required for storage, and more efficient information retrieval. In addition, students will be able to access curricular content and communicate with faculty through digital technology.

Medicine, as a profession is changing at a rapid pace. The teaching and learning required to train doctors must appropriately mirror that process in order to produce practitioners who are able to practice at the most up-to-date level. Digitization must be at the core of the learning process in order to achieve that objective.

Though resistance to change may impede this progression, benefits of digitization for COMHSc outweigh the challenges. Significant cost savings, increased student satisfaction, and more efficient use of staff time and space provide evidence that this transition will move COMHSc in the right direction.

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