Administering a Gross Anatomy Exam Using Mobile Technology

How one medical school made the switch from paper to paperless.

By Alireza Jalali, Daniel Trottier, Mariane Tremblay, Maxwell Hincke / February 2011

Mobile technology has infiltrated medical school education. Students now bring tablet PCs, rather than notebooks, into the classroom. They can access Web-based curriculum during lectures and add notes directly to their files. At the Faculty of Medicine University of Ottawa the curriculum for the first two years is online, and PDAs have largely replaced reference books for students in clerkship programs. And more telling, employees at Ottawa Hospital Medical have been encouraged to replace pen and paper notes with iPads. Thus, transitioning from written to digital examinations seemed to be a reasonable next step. To assess the benefits and drawbacks of this approach, we developed a mock anatomy examination using the Questionmark software and compared its administration and evaluation on two electronic devices.

At the Faculty of Medicine of the University of Ottawa, gross anatomy is taught during the first two years of medical school. The course is divided into four units: musculoskeletal anatomy; the thorax, head and neck; the abdominal and pelvic cavity; and neuroanatomy. Students attend anatomy lectures and laboratories almost every week. After each unit students take
a final laboratory examination, they also take a timed midterm examination. During each examination, students rotate through 20 (midterm exam) or 40 (final exam) stations in the laboratory covering anatomy, pathology, radiology, and a few other disciplines. Students spend two minutes at each station and answer two to four multiple-choice questions (MCQs). MCQs are frequently used in medical schools because they are reliable and allow for rapid marking and prompt feedback to learners (Fowell and Bligh, 1998); also MCQs can be used to examine higher levels of learning (Collins, 2006).

Our goal was to eliminate these paper examinations and move to an online version. As instructors we use guidelines from the National Board of Medical Examiners and the Medical Council of Canada to aid us in constructing our examination questions (Case and Swanson, 2002; Touchie, 2005). Since the students are taught using cadaveric specimens, their examination should also include such specimens. However there are disadvantages: Voluminous amounts of paperwork need to be organized. In proctoring seven examinations a year to 150 students, we use approximately 35,000 pieces of paper. It takes time to prepare the printed examinations, organize the examination stations, and then to carry all of the papers to the laboratory before the examination. It is also time consuming to correct the examinations and communicate results. Besides the issue of sustainability, online evaluation would save administrative time and money in addition to helping us to provide faster feedback to students.

**Experimental Procedures**

To move from a paper-based examination to an online version, we researched available hardware and software. We decided to use a portable device, which would allow us to continue to use the timed examination, the students would also be able to move easily from one station to
another. After a discussion with our medical technology team, we chose two tablets for this study that were light weight and had fast screen reaction time and long battery life: the Lenovo S10-3t running Windows 7 Enterprise and the Apple iPad Wi-Fi 64GB running the iPhone 3.2 OS.

With all the available options, we tested numerous learning applications. Students were already comfortable Questionmark Perception and it was compatible with existing technologies being used at the school. The tool allows the creation of a question bank in different languages, which is very useful for our bilingual university. Also the ability to create 12 types of reports was useful, specifically the coaching report. The student can see detailed information, including the answers and scores for each question, which is used to help coach individuals through their learning curves. Furthermore, Questionmark Perception makes it possible to return to and continue a previously started examination via an auto-save feature. This feature is not Wi-Fi dependent and, therefore, lends itself well to a potentially unstable Internet connection environment and provides confidence for use during a live examination. For all of these reasons, our university purchased a license for Questionmark; eventually all of our written examinations at Faculty of Medicine will be created using the software.

Our data collection method was straight forward; we set up a mock anatomy examination using four stations, each having two MCQs. A student, an IT staff member, and a faculty member, who were all familiar with the paper-based examination, completed the examination first using the iPad, and then using the Lenovo tablet. The volunteers had two minutes at each station. Afterward they were individually questioned about their general impressions of the online examination and their preferences regarding the devices used.

Results
We identified numerous benefits and challenges related to the method. All of the participants liked the idea of an online anatomy examination to replace the paper version. Ease of use and immediate feedback were among the advantages they identified. The two main disadvantages identified were the stress related to not having an examination paper in hand and dependence on a potentially unreliable Internet connection. The participants found that an online examination added to the stress of taking the examination. The participants worried that their responses would not be recorded by the machines and that their answers might not be submitted.

**Conclusion**

Although the online examinations may help faculty administratively, it will present challenges. Students may be stressed by undergoing a new method of examination and will require suitable orientation. The choice of hardware and software also needs to be considered carefully, as the examination might render differently depending on the selected technology. During our study we discovered depending on the selected online examination tool, an online exam will render differently on the iPad compared with conventional laptops and tablet PCs. This is mostly due to the fact that iPad uses Safari as browser instead of the more widely used Internet Explorer.

Consequently achieving the desired look and user experience required modifications to digital files; even our method for organizing the examination was affected. However our preliminary trials established that an iPad and the Questionmark software was a suitable combination to use for a timed, online anatomy examination. This recommendation is in line with the Ottawa Teaching Hospital's decision to use the iPad at the patient bedside for clinical purposes.
Our hope is the transition from paper examinations to an online version will save faculty members time, but also improve the evaluation process for students. An electronic exam will also translate into cost savings for the university. Moreover the final licensing examination administered by the Medical Council of Canada is taken on a computer, adopting an online anatomy examination will offer students much needed practice and, it is hoped, better preparation for such professional examinations.

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**About the Authors**

Alireza Jalali, M.D., is a Francophone professor of anatomy at the Division of Clinical and Functional Anatomy, at the Faculty of Medicine, University of Ottawa, Ottawa, Canada. His research explores the use of technology and more particularly the Web 2.0 tools in medical education.

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Mariane Tremblay is a multimedia and learning technologies designer at the Medical Technology Office at the Faculty of Medicine, University of Ottawa, Ottawa, Canada. She is fascinated with the use of new technology in medical education.

Maxwell Hincke, Ph.D., is the Head of the Division of Clinical and Functional Anatomy at Faculty of Medicine, University of Ottawa,
Ottawa, Canada. He is very interested in the use of novel technology for teaching anatomy in the medical curriculum.

References


Comments

Sat, 04 Jun 2011
Post by Ali
Thank you Shakil for your kind reply. We'll keep you guys updated on our progress. Ali

Fri, 03 Jun 2011
Post by Prof M. Shakil Siddiqui MBBS,MS,PhD
Congratulations for use of future technology in medical education.Improvements with time will make PERFECTION. Shakil

Sun, 13 Feb 2011
Post by Ali Jalali
Hi Ryan, Our students do have weekly online quizzes. Using iPads for those is a great idea and can help with reducing the final exams' stress. The students can only take the Anatomy exam in the laboratory, as each
question is linked to an anatomical specimen. Thanks Ali

**Sat, 12 Feb 2011**
**Post by Ryan Tracey**
I appreciate the students' concerns regarding online exams, but I think practice exams and perhaps weekly pop quizzes (worth minimal marks) would do much to alleviate those concerns. I am wondering if you intend to allow students to undertake the exams wherever they wish (at home, in the office, on the bus etc), or will you still require them to turn up at a physical location?

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