Enhancing Medical Students Exam Revision Course with Modern Classroom Response Systems

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Abstract. To prepare German medical students for their state exams, they get short, but intensive lessons about each exam topic. These lessons are all about answering teacher-selected, pivotal multiple choice questions. In the past this has been done by hand raising or hardware clickers, which was time consuming, expensive or both. Nowadays modern Classroom Response Systems (CRS) replace this functionality by using the mobile devices the students already have. Our main objective is an easy-to-use, real-time multiple choice question system in lessons with many medical students. In our study we use the modern CRS "Tweedback" to accomplish this requirement and outline a working setup, expose its advantages and reveal its disadvantages to show a suitable modern CRS usage in medical students exam preparation courses.

Keywords: Classroom Response Systems, Medical Exams, Realtime Multiple Choice Questions, Mobile Devices

1 Introduction

Medical Students in Germany have to pass two state examinations to become a certified physician. They have to pass the first state examination (two days) at the 4th semester. Then they have to pass the final state examination (three days) at the 10th semester. Both exams cover a vast area of topics and medical knowledge.

To support students to prepare for these exams, the medical faculty at the University Medical Center Rostock offers intensive 45-minutes lessons on most exam topics. Because both state exams consist of multiple choice questions (forced choice) with five answers, these lessons are about selected questions. The teachers select interesting or difficult questions beforehand and handle them step by step in their lessons. Therefore these preparation courses aim to show which knowledge is important, to clarify difficult terms or methods, to teach how students can identify catch-phrases and - most important compare and check their level of understanding. In the past this has been done by hand raising. Teachers had to count the answers or at least estimate the amount of students for each answer. The whole process is very time consuming. Furthermore it is difficult to catch swing-voters.

In the last years hardware clickers (remote controls) took over the part of counting: Students got a remote control and could press a button instead of raising their hands. This is less time consuming during the vote, but costs more time and money before and after a lesson. Each device has to be purchased and maintained, which means there has to be somebody, who changes the battery if necessary, hands out the devices before and collects them after each lesson. Furthermore these systems become complicated to set up if a large audience has to be addressed.

Nowadays modern Classroom Response Systems (CRS) [1], [2], [3], [4] can replace this functionality: Because most student have their own mobile devices such as notebooks, tablets or smartphones, a modern CRS can provide a multiple choice question to this device, collect all answers and present the results to the teachers screen in real-time. Using such a form of modern CRS nothing has to be maintained or bought and all results can be accessed afterwards.

Our main objective is an easy-to-use real-time multiple choice question system in lessons with many medical students, who need to get through a lot of teaching stuff in a small amount of time. Because hand rising is too time consuming and clickers are too expensive and have to be maintained, we use a modern CRS to accomplish this requirement. Furthermore students and teachers should be able to access their answers to compare their level of learning and understanding with their fellow students. This allows them to check if they fit their learning plan or not. Moreover we take advantage of students mobile devices to transform them from
a social-network-distractor into a unified learning tool [6].

2 Setup CRS for Preparation Courses

Making use of the students devices implies that all students really bring their own devices. Therefore announcing and explaining CRS usage beforehand is important. Furthermore it is necessary to ensure WiFi-coverage for all students (in our case: for more than 150 students of first state exam and 400 students for students of second state exam). This requirement has to be highly prioritized in all planning regarding the room.

To avoid a complicated, time-consuming usage introduction, Tweedback does not need any preregistration and generates a unique id, called lesson-id, for each usage scenario. Therefore teachers have to create such a lesson-id or simply reuse the lesson-id of the previous lesson and activate the quiz functionality. After providing this lesson-id to the students they are immediately able to provide feedback anonymously in this scenario: to give answers on teachers multiple choice questions. Furthermore the lesson-id ensures the courses confidentiality even if there is no registration-process.

Because this usage scenario deals with up to five teachers per day, it is necessary to build up a setup that enables every teacher to focus on their selected set of questions. Hence all teachers should submit these questions beforehand, so they can be combined into ready-to-start slides.

Furthermore it is mandatory to configure and adjust all technical devices. In our case there were two presenters for the teaching stuff (multiple choice questions), because some question are too long and may exceed the screen size, and one presenter for the CRS voting results. One person was responsible for creating the CRS quizzes and showing their results, whereas the teachers concentrated on the slides with their questions. When teachers start their lesson they had nothing to prepare or configure. Thereby they are empowered to immediately dive into their topic. Figure 1 shows our specific setup.

3 Results, Insights and Open Issues

Because Tweedback offers a web application that is built on top of a database, teachers and students are able to use this CRS anywhere at any time with only a web-browser [5]. Further students are not only able to compare their results at the time teachers show the correct answers, they are also enhanced to access the answers after the lessons or even the whole course has happened. Tweedback is storing all answers anonymously in its database and presents only the aggregated results on each question.

The preparation course itself was focused on the usage of multiple choice questions to be similar to the real exam situation. Therefore the courses covered the most comprehensive topics. In detail this means the preparation course for the first state exam proceeded on 4 following days with each 3 lessons over 45 minutes. Main topics were anatomy, biochemistry, biology, chemistry, physics, physiology and medical physiology. Day 1 to day 3 are labeled as m1-day1 to m1-day3 in the following. The course for the second state exam proceeded on 6 days in 2 weeks with each 3 lessons (45 minutes), too. All six days are labeled as m2-day1 to m2-day6 in the following. Main topics on this course were anesthesiology, dentistry, dermatology, general medicine, gynecology, internal medicine, neurology, orthopedics, pediatric medicine, psychiatry, surgery and urology.

The total number of unique devices per day is shown in Figure 2. The first three bars show that there were 118 devices, or 118 students respectively, on the first day (m1-day1), 57 on the second day (m1-day2) and 18 on the last day (m1-day3). Compared to the expected maximum of 150 students, who are registered to the first state exam, this shows that most students attend at least the first day of the preparation course. The decreasing number of students may relate to the exam topics, but this is speculative at this point. The distribution for the preparation courses for the second state exam look very similar and decreases over time, too. Starting with 228 students on the first day (m2-day1) and going to 120 students on the second to the last day (m2-day6), this number slightly increase up to 128 students on the last day.

At all time the number of simultaneously connected devices has never been a problem. The WiFi coverage as well as the Tweedback-Server itself have been working without any errors. Moreover the most teachers confirmed that they processed the results of their questions' answers much faster, which is why a lot of teachers had to use their backup-questions (backup-slides) to completely fill their 45 minutes.

Even if the technically setup worked as assumed, we recognized the following open issues. Empty batteries are real struggle, even in 2014. Some students start with half-charged batteries or own mobile devices which are not capable to be connected more than 4 hours permanently to a WiFi. A room with sockets for each chair may be a viable solution. Furthermore there are still students, who do not have a mobile device. A solution can be lending devices or a functionality to reuse the neighbor's device. Moreover copy-cats may be a problem when the device
running Tweedback’s teacher mode is turned to the students. Because only the teacher mode shows intermediate result, we recognized that students who are able to see this intermediate result tend to wait until they see a dominant answer.

Based on the fact that most students own a mobile device, modern CRS are cheaper as hardware clickers as well as in time as in money. They cost a minimum to setup and nothing to be maintained. In our scenario only a presenter has been plugged into the teachers CRS view. Because Tweedback does not require any registration process or extra software it has nearly no entry threshold, which makes it instantly usable.

Even if we showed that modern CRS are usable for hundreds of medical students for their preparation courses with multiple teachers, it is important that the CRS usage is annotated and explained beforehand. Therefore students are able charge their own mobile device and bring them to the course.

Moreover teachers and students are able to access the answer results afterwards, so they are able to compare their level of understanding or check if they are still fitting their learning schedule.

5 Future Work

Further research may focus on the correlation between students CRS usage and their exam grades. For the sake of students’ anonymity we were not able to investigate this question.

At the moment the whole setup requires a digital communication channel, as WiFi. Further researcher may want to look into alternative setups. It may be possible to provide a “Bag of CRS” which contains a CRS-Server and a WiFi Access Point for example. This could be an interesting application
for educational environments that are not able to provide a consistent WiFi infrastructure.

Additionally it may be interesting to share teachers view to multiple devices, so the person, who controlled Tweedback, can share it’s Tweedback screen to the teachers devices.

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