Quizrific: an Android-based app for examinations

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ABSTRACT
In this fast-growing era of technology, where more than 2,5 billion people of the world population own a smartphone, there is a lot of potential for software applications to solve more or less trivial problems, literally by just one "touch". This paper focuses on taking this technological advantage and using it in the education sector, by presenting the development of an Android-based school preparation and examination system, designed for both students and professors.

Author Keywords
Quiz-taking application; Learning management system; Game-based learning; Mobile educational platform.

ACM Classification Keywords
K.3.1 Computer Uses in Education; H.4.m. Miscellaneous.

General Terms
Human Factors; Design.

INTRODUCTION

With the rising number of personal smartphone ownership, along with the fast-paced world children grow up in, having a school-related mobile application can be the key to creating a strong bonding between students and school. Quizrific is, therefore, the solution we propose in order to improve the way students prepare for a quiz. It eases the evaluation procedure for the professors and provides easy to grasp metrics of the learning progress, useful statistics on the educational process and, overall, increased satisfaction of both students and teachers.

Types of Quizzes

From the beginning of education, a clear structuring format has proven to be a good approach to refine knowledge and abilities: studying and assessment. At the moment, there are multiple forms of assessing one's capabilities, many of which can be ultimately coordinated by a machine.

Multiple-choice questions are a popular format among many international standardized examinations, such as the SATs (Scholastic Assessment Test) or TOEFL (Test of English as a Foreign Language) [1] [2]. A question of this type requires a set of possible answers shown to the examinee, among which one or more are correct and the others serve as distractors. A common rising problem could be the lack of testing whether the student did some reasoning while coming up with the answer or he randomly picked it and got lucky. To avoid this, a 'guessing penalty' can be introduced, so as any attempt at choosing an answer without careful consideration would be discouraged [1].

Fill-in-the-blanks questions provide another interesting approach to test more accurately what the examinee is thinking. This type of question requires the learner to complete a given sentence that is missing certain words. Further hints can be attached to help at deciphering the correct answer [1].

Match-the-pair and *sorting/labeling* quizzes can also be easily implemented in a software program to reinforce studied concepts. Students are provided with a list of certain notions and have to correctly pair them with members from a second related list, sort them in the correct order or classify them under the correct label [1].

In our application, we have decided to use multiple-choice questions, in order to provide a certain degree of flexibility for both professors and student (Figure 3).

RELATED WORKS

In spite of the fact that there are plenty of quiz-taking related applications and games, most of them are designed merely for amusement, neglecting educational purposes. Those that truly focus on the latter are limited by the range of categories they provide.

Out of desire to promote education through this medium, a group of researchers at the Institute of Computing and Information Technology Gomal University in Pakistan have written a paper on implementing such a project [3]. Using MIT App Inventor software, they created a multiple-choice quiz app for Android that students could use to select from three categories to answer related questions. A question can have only one correct answer and offers one-time special features like hints, pausing or skipping. However, a fixed question bank is required for the app to run smoothly.

Another similar approach was taken in the project of developing a quiz system in Android using Java and SQLite, described in [4]. Their app is focused on testing the knowledge of the C++ programming language and consists of a question bank of multiple-choice, true-or-false and fill-in the-blanks types of questions. It features a timer and a scoring system, as well as the option to review the wrong answers given by the examinee to learn from his/her mistakes. A prototype called *Quiz It* incorporates a mobile

module for the lecturer, one for the student, as well as a web environment meant for administrative tasks [5].

Taking quizzes, doing assignments, studying courses anywhere, anytime is equivalent to a ubiquitous learning environment in which students can be highly focused on the learning task. There is a related project on this matter created for the Android platform that retrieves courses, tests, grades from the database through a third-party library based on the SOAP architecture [6].

THE PROPOSED SYSTEM

Our application is meant to be used by professors and students altogether. The main technologies used for building the final product are Java, PHP, MySQL, node.JS, JavaScript and socket.io. The architecture of the system is depicted in Figure 1.

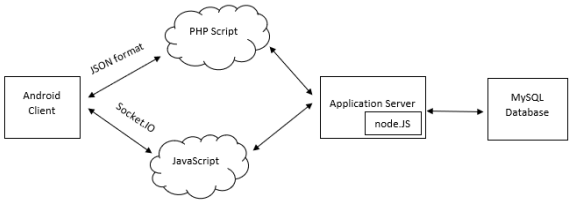

Figure 1. The architecture of Quizrific.

From the professor's point of view, the aim of Quizrific is to give him/her the freedom to create his/her own quizzes for students to take at a scheduled date and time, eliminating the time-consuming after-work activities like grading test papers. Another advantage is that the professor can easily track the progress of his/her students, based on current and previous quiz results.

As youngsters nowadays tend to spend a significant amount of time on their phones, Quizrific becomes a useful tool that students can use anywhere, anytime they please, as long as they have Internet access. Students do not necessarily have to stay at their desk, in front of the computer to get ready for the next day at school. This attractive, flexible nature of the application is intended to allow students to even do a quick preparation on the bus on their way to school.

Similar to the case of the professors, with the help of Quizrific, students spend less time worrying while waiting for a result. Every correct answer is graded properly and added to the final grade, so that the scores are calculated rapidly and displayed accordingly, after finishing the quiz. Since every evaluation should rely on identifying the mistakes the student made and help him/her at achieving a better understanding of the material taught at school, the focus is shifted from plainly displaying the final grade to encouraging the student to go through the parts of the quiz where he/she responded incorrectly and review what the correct answer is.

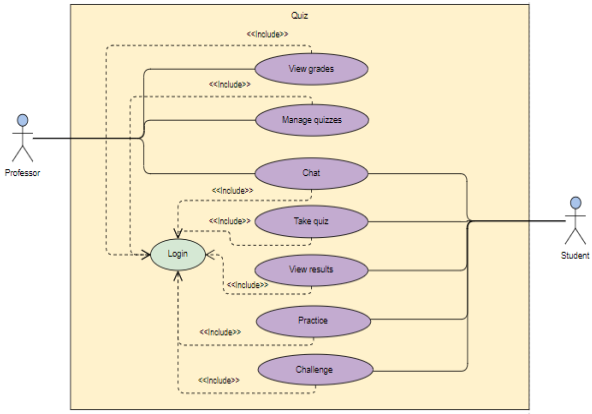

Figure 2. Use case diagram for Quizrific.

Additionally, informative charts and statistics are generated after every quiz, for the student to clearly asses his/her level of knowledge, get encouraged to improve it (or maintain the already-attained perfect score) and get a glimpse of how his/her efforts turn into real better results (figure 6).

Aside from doing practice quizzes individually, a more fun way to prepare for school is forming the so-called group-study where students can help one another by discussing and sharing ideas. Quizrific incorporates both types of preparation methods. In the first manner, students have access to a set of quizzes proposed by their professors for them to practice on.

Individual testing

The workflow of practicing on individual questions is the following: the student is shown one question followed by a set of answers, he/she chooses an answer and immediately sees if it is correct or wrong, keeps searching for the correct one and has the option to save the respective question for later reviewing. There is no time limit for this module, as the student is encouraged to take his/her time and vigorously assimilate the information.

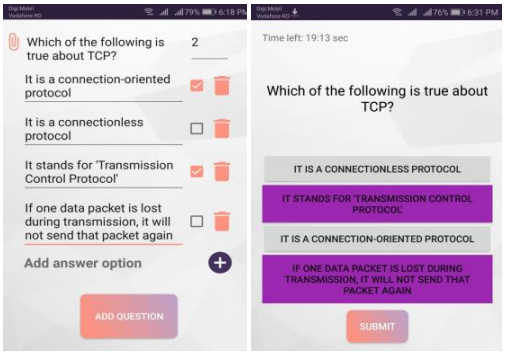

Figure 3 Multiple answers can be correct.

Collaborative testing

For the collaborative method of learning, Quizrific has implemented a multiplayer module, called *Challenge*, where students can compete in real-time against one another in a simulated environment of a quiz (see Figure 4). A *Challenge* consists of two students connecting to the server and getting the same quiz containing a set of questions in the same order. Each question has multiple answer options of which only one is correct. Both students have a limited amount of time, i.e. ten seconds, to choose the answer they think best suites the given question. After the timer is done, the correct answer along with all the players' answers are shown in a short timeframe, so that the players can learn what the accurate answer is and if the opponent has chosen it. For each correct answer, the player receives one point. If a wrong answer is given, or none at all, one point is subtracted from player's score, unless it is equal to zero. At the end of the quiz, the player with the biggest score wins (if both players acquired the same score, they are both equally declared winners). This competitive game-like quiz-preparation can consistently help at motivating students to improve their expertise on the specific subject and defeat their opponents.

As it is an application designed in the first phase for university studies, before creating a quiz, the professor first selects the department followed by one of the courses taught in that specific department. Then, the professor writes the question, decides how many points it values, and proceeds to add up to five answer options. Any question has to have at least two responses, of which one correct and one wrong. All the points of the questions should sum up to a final mark of nine, one point being granted automatically at the calculation of the student's score.

Another feature Quizrific offers is that the professor can add images from which students to extract the correct answer(s). Future improvements include the option to add not only images, but also video, audio or pdf files through which more abilities like effective listening or reading comprehension could be assessed.

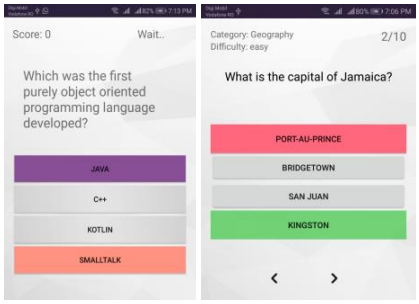

Figure 4 Multiplayer mode versus individual practice.

Thereafter, the professor can view the list of created quizzes, schedule them, edit their contents, or even delete them (see Figure 5). All these are possible through the help of intuitive and modern user-interface design which makes use of user-friendy features provided by the Android SDK (Software Development Kit) such as swiping or scrolling gestures.

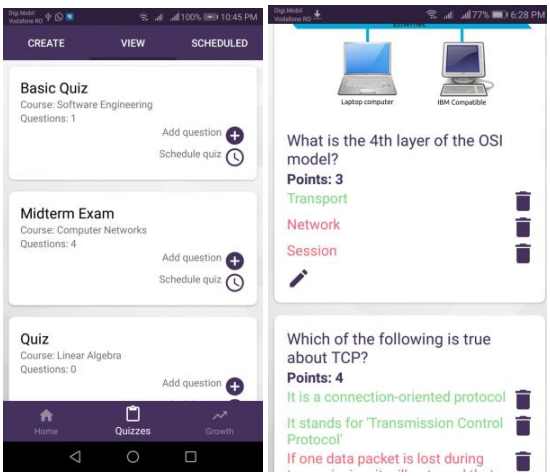

Figure 5 Viewing and editing quizzes.

To schedule a quiz, the professor has to pick an appropriate date, time and duration for the quiz to take place. Scheduled quizzes can be visualized in a separate tab, strikethrough text being used for past quizzes, green-colored text for upcoming ones, and green along with pulsating text for ongoing tests.

Once a quiz is done, i.e. the timer has stopped and students can no longer answer to questions, all their final grades are included in a pie-chart in which the professor is able to clearly visualize how many students have passed and how many failed – the passing grade considered five out of ten (see Figure 6).

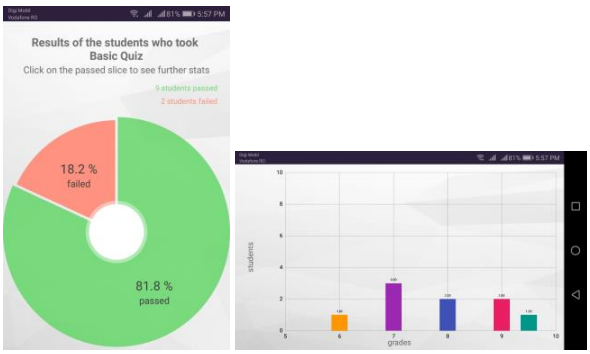

Figure 6 Screenshot of quiz results shown in charts.

In addition, a more detailed bar-chart can be extended to observe how many students got a certain grade. Last but not least, an individual line chart containing the results obtained at a certain course over a longer period of time provides the professor with the necessary information to analyze which student has improved drastically, who is better at a certain subject or who needs more help at grasping the notions presented at school.

Quizrific was developed in Android Studio; the graphical interface was designed with XML and the functionalities were programmed in Java. For storing users' details, quizzes, results, etc. we chose MySQL as the database management system. In our case, relational was preferred over NoSQL, because integrity constraints were considered very important in the care of our app. A server-scripting language like PHP was also needed to act as a bridge between the Android client and the database on the server.

For the real-time functionalities – the communication system and the quiz competition – the web server was configured with node.JS and then, we used JavaScript and Socket.io (a JavaScript framework for web sockets) to code the dynamics of the application.

The target group for this application involves users in two categories: students and teachers. Among these, a representative sample should contain users of various age-groups, and various backgrounds with respect to technology usage. However, at this point, the app was tested on a sample of 12 students from the Faculty of Computer Science and Mathematics, Ovidius University of Constanta. The testing procedure involved the students taking a quiz with questions from the Computer Networks discipline (Computer Science track, 3rd year of studies). The results of the assessment are encouraging, the students considered the app useful for the purpose of learning.

One expert teacher was asked to evaluate the system. She considered the app is task oriented and displays consistent information, yet was intrigued by the numerous testing possibilities and suggested that the app provide several short films of its usage, together with an explanatory user guide. Further usability testing needs to be employed, in various scenarios and with more representative samples of users [7].

CONCLUSIONS

The application presented in this paper is intended to be a useful tool for students and professors altogether. Created for student preparation and evaluation, the attention might seem concentrated on the student, but in fact, professors play a big role in the application, as they are the ones that populate the app with quizzes that students can practice on or actually take at a certain date and hour. Quizirific fulfills professors' needs by bringing in one application the possibility to create a quiz, view the results and get in touch with their students in real-time. It automatically calculates the final grade, taking into account partial credit, so professors are exempted from spending their time grading papers. Students can easily prepare for different subjects, by taking practice quizzes or competing against each other in a simulated environment of a quiz. Statistics and charts are used to visually motivate students to improve their overall grades.

Although there have been implemented e-learning projects that test students' grasp of the studied material, Quizrific comes with its own contributions like: the multiplayer challenge system that allows students to play in real-time and treat quiz preparation as a game, the ability to communicate directly between students and professors (professors having the option to send important notifications to their students' phones) and all the other features incorporated in the same application.

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