Real-time Interaction Platform for Classroom Teaching Based on Smart Phone APP

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Abstract. Recently the popularity of smart phones has promoted communication for daily life, but it also brings new challenges for current classroom teaching. For example, some students spend too much time on playing phones instead of learning in the classroom. How to effectively instruct students to use phones and promote teaching becomes a very tricky problem. In order to deal with this problem, we propose a new real-time interaction platform for classroom teaching based on smart phone APP, which adopts the extensive multilayer framework and the quantifiable real-time interaction. In this platform, it’s easy for teachers to set questions at any time or place, start exercises in class and view real-time statistical analysis results. And it’s also easy for students to answer questions in exercises and view results after finishing exercises. What’s more, this platform can strengthen the interaction between teachers and students, and stimulate the interest of all students to participate in classroom learning. Results show that our platform can improve teaching effect.

1. Introduction

In recent years, with the rapid development of network information technology, many new teaching modes and methods have emerged in education [1, 2], such as network course [3], MOOC [4], and flipped classroom [5]. Though these new modes can make teaching convenient for cross-regions, classroom teaching is still a very important teaching mode in the current education environment. As we known, currently in most universities, only a tiny minority of the curricula are completely using the network-based teaching, and the vast majority of the curricula are still based on classroom teaching. The reason is that classroom teaching between teachers and students can be more direct for face-to-face exchanges and discussions. But classroom teaching faces some challenges. On the one hand, roll call-based interaction in class is still unsatisfactory. Not all students are involved, and even some students may not really think about the question. What’s more, current classroom teaching lacks the real-time total feedback of efficient attendance statistics analysis. On the other hand, almost every student has a smartphone on campus. Although smartphones bring a lot of convenience, they also bring some problems. Students may play with mobile phones in class. Under the new circumstances, how to improve classroom teaching effect remains a difficult research topic.

Some efforts have been made to enhance classroom teaching. Many universities have introduced some modern teaching experimental platforms [6] in the classroom teaching, but these platforms focus on experimental teaching, and rely on specific equipment support. Clicker is a typical interactive
assistant tool for classroom teaching [7], which is mainly composed of hand answerers, wireless master base stations and data processing software. This tool is not suitable for our class, because each student needs to hold a hand answerer device. Mobile-based learning is another latest way for education [8], but this way mainly focuses on network course for students’ learning after class, not for teachers’ teaching in class. Different from existing research, we concentrate on using the smart phone that everyone has, and developing a platform to realize real-time interaction and statistical feedback in the classroom.

To deal with the shortcomings of the existing classroom teaching, we propose a new real-time interactive teaching method, which constructs a real-time interaction platform for classroom teaching based on smart phone APP. In the platform, the multilayer framework is designed to ensure the robustness and extensibility of the platform. In addition, the real-time teacher-student interaction process is provided. Furthermore, implementation and experimental results are reported to show the effect of the platform.

The rest of the paper is organized as follows. First, section 2 presents the details about the proposed real-time interaction platform for classroom teaching. Then, section 3 discusses the implementation and results of our platform. At last, section 4 gives a summary of the paper.

2. The real-time interaction platform for classroom teaching
Classroom teaching does not only mean instructing knowledge, but also needs effective real-time interaction to check the teaching effect and adjust teaching strategy. In particular, smartphones are widely used in current university classroom. The attention of students may be easily transferred to play phones, which results in bad effects and brings new challenges for classroom teaching. In order to promote the classroom teaching, we propose a real-time interactive classroom teaching platform based on APP, which strengthens the teacher-student interaction in class. A multi-layer framework is designed in the platform to ensure the robustness. What’s more, the real-time teacher-student interaction process is explained.

2.1. Framework overview
In order to ensure the robustness and extendibility of platform, we adopt a multilayer framework in the real-time interactive classroom teaching platform, as shown in Figure 1.

The whole framework is divided into four layers: data layer, data service layer, business layer, and app presentation layer. The bottom layer is data layer, which stores the different data involved in the platform, and provides the basic data models. Based on the data layer, data service layer is a data communication layer to support data accessing, data inserting, data updating and data deleting. Business layer focuses on the related business functions, such as question management, exercise management, user management, student answering, and statistical analysis. This layer can call the data services to indirectly access the data. The top layer is app presentation layer, which denotes operation interfaces for teacher terminal and student terminal. Teachers can use the interfaces to add question, start exercise, view answering results, and so on. Students can use the interfaces to answer questions, view results, and so on. The functions behind the interfaces are implemented in business layer. High cohesion and loose coupling between different layers can also facilitate the maintenance of the platform.
Figure 1. Framework of the real-time interactive classroom teaching platform

Based on the smartphone APP, this platform combines the real-time interaction in class with the real-time evaluation of teaching quality. The core businesses of the platform include teacher-side data management, student-side answer management, and multidimensional statistics analysis. They are explained as below:

1. Teacher-side data management includes the importing of existing data, student management, question management, exercise set, exercise start, answer information view, and so on.
2. Student-side answer management includes answering questions according to the teacher's exercise tasks, submitting the exercise, viewing the results, viewing historical answers and so on.
3. Multidimensional statistics analysis includes individual or overall learning situation statistical analysis, student attendance statistical analysis, average score statistical analysis, and short-term or long-term statistical analysis.

2.2. The real-time teacher-student interaction process

Unlike the tradition classroom teaching, the platform provides the real-time teacher-student interaction in class. Teachers and students firstly log in the platform based on smart phones. The real-time interactive activity diagram is depicted in Figure 2.

The teacher starts an exercise, and then the student can begin to answer the exercise. Student should submit answers within the specified time. When the time comes, the exercise is automatically finished. After exercise, the student can view the results, and the teacher can view the statistical analysis results about answering. Based on the real-time feedback, the teacher can further conduct key point analysis and adjust the teaching strategy. Those questions in the exercise that are widely answered correctly means the related knowledge is understood well. In contrast, the knowledge related to those questions in the exercise that are widely answered badly requires further deep clarification.
This interactive function can be used to assess students' mastery of knowledge. Meanwhile, it can also be used to assess the teaching methods of teachers. The platform can send questions to students on the spot through the APP-based platform immediately after the teacher has finished teaching a certain knowledge point. Students can submit their answers within a specified time. Teachers can accurately grasp the students' acceptance of the knowledge point and timely evaluate the teaching effect of the knowledge point. It also provides basic interaction data for the students' attendance analysis, the students' learning situation analysis, and the teachers' own teaching quality analysis in the semester or academic year. What’s more, teachers have more diversified ways of setting questions, not necessarily at home or the office to use the computer to set questions, but can take out the mobile phone APP at any time and place to set questions quickly.

3. Implementation and results
The platform is implemented based on android eclipse. Mysql is used to store the server data. The back data services, which interacts data with Mysql, are encapsulated by the myeclipse tool. Users should adopt their account name and password to login the platform. Different users have different privileges. The teacher has authority to manage questions, exercises, student users and view real-time statistical analysis results. For example, the main operation interface of the platform for the teacher is shown in Figure 3. In addition, Figure 4 depicts part of the student answering statistical analysis result example for one class after an exercise. In our college, usually one class have 30 students. In the Figure 4, the x-axis denotes the different answering score sections, and the y-axis denotes the numbers of students.
To demonstrate the performance of the platform, we apply the platform to serve for our orientated object programming course teaching. We conduct five exercises to initially test the attendance statistics analysis and the average score statistics analysis in the 2017-2018-2 semester, as shown in Figure 5 and Figure 6 respectively.

From the Figure 5, we find that almost all students actively participate in the interaction by this platform after three exercises. Based on the platform, the student attendance in class has achieved significant improvement. Compared to the traditional oral calling way, our method with the proposed platform is more efficient.
From the Figure 6, we find that the average score of students is promoted after multiple exercises. Combining classroom performance, we discover that students take strong interest in the interaction platform, and students become more conscientious in class than before. In addition, with the platform, the final average score of the 2017-2018-2 orientated object programming course reaches 81.0, which
is higher than the final average score 72.8 of the 2017-2018-1 orientated object programming course without this platform.

Through the application of this platform, teachers are more convenient in preparing or conducting classroom interaction. It is not necessary for teachers to set questions by computer at home or in the office. Instead, teachers can take out mobile phone APP at any time and place to set questions quickly. Teachers can start exercises immediately in the classroom, establish interaction with all students, and stimulate students’ interest in learning. Moreover, it’s easy to find out students' attendance, students' learning situation, grasp students' mastery of knowledge, participate in answering questions, and make timely comments or teaching adjustments. On the whole, the teaching effect has been obviously improved by using the platform.

4. Conclusion
This paper proposes a real-time interaction platform for effective classroom teaching. In this platform, a multi-level framework is designed to ensure the robustness and extendibility. The real-time teacher-student interaction process is provided to further improve classroom teaching. Implementation and results indicate that the proposed platform can improve the teaching effectiveness.

In the following work, we will try to further improve current platform. For example, we will enrich the platform with more rich statistical functions to meet multi-granularity requirements. In addition, the platform is just partly applied to classroom teaching in the orientated object programming course, and we will launch more trials to demonstrate our platform in more courses.

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