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Research on the Reform of Project based Teaching in Mobile Android Development

Xiaoshuo Jia*, Zhihui Li

Guangdong University of Science and Technology, Dongguan, China
***Corresponding author:** Xiaoshuo Jia

Abstract: As a compulsory course for software engineering and IoT engineering majors, "Android Mobile Application Development" focuses on Android core components, data storage, and map applications, aiming to cultivate students' ability to develop Android applications for IoT terminals. In response to the common problems in current computer education, such as excessive emphasis on theoretical courses, insufficient cultivation of practical abilities, and a disconnect between graduates' skills and the needs of enterprises. This article proposes a project-based learning model that can effectively stimulate students' autonomy, innovative thinking, teamwork, and engineering practice abilities by guiding them to solve real and complex engineering projects, which is in line with the goal of cultivating applied talents.

Keywords: The Reform of Project, Mobile Android Development, C Program.

1. Introduction

"IoT Android Application Development" is an elective course for both Software Engineering and IoT Engineering majors, focusing on application software development and design based on the Android operating system. The main content of this course includes: Android core components, user interface design, data storage and access, map applications and positioning, and Widget component development. The course adopts commonly used mobile applications and game software as project teaching vehicles, enabling students to understand the methods and approaches of Android mobile software design. This lays a solid foundation[1] for subsequent courses and prepares students for careers in Android mobile software development.

The main feature of the course lies in its emphasis on the integration of theory and practice. Students are required to not only learn relevant theoretical knowledge but also participate in in-class practical activities, such as project development and experimental operations, to deepen their understanding[2]. Additionally, the course focuses on cultivating students' innovative thinking and teamwork skills, encouraging them to take initiative and demonstrate creativity when solving practical problems. Through this course, students will be able to independently or collaboratively develop Android software products, meeting the demand for IoT Android application development talent in their future careers.

In recent years, universities both domestically and internationally have been continuously striving to explore reforms in the training models for computer science professionals[3]. However, due to the unique nature of the computer science discipline, the formulated training programs must not only emphasize the importance of theoretical foundation learning but also balance the cultivation of practical skills. As a result, courses with high theoretical difficulty still occupy a significant proportion in these programs. Given the extensive knowledge scope and strong interconnectivity between courses in computer science, the training programs involve a large number of courses. This training model presents certain challenges for applied universities, as it fails to enable students to acquire a solid theoretical foundation while also struggling to effectively enhance their hands-on and application abilities. Consequently, the quality of talent cultivation remains subpar, and the courses studied by graduates fail to meet corporate needs.

With the rapid update and replacement of software technology, the skills learned by graduates trained according to the training plan formulated by students at the time of enrollment cannot meet the needs of society and enterprises to a certain extent, forming a supply-demand contradiction where a large number of graduates find it difficult to find jobs that match their majors after graduation. Therefore, the reform of software engineering courses in applied universities should be based on mastering necessary theories, with the goal of addressing the practical needs of enterprises, and reforming the teaching mode of courses. However, there are still significant shortcomings in the cultivation of college students' abilities, especially in engineering practice, in current higher education institutions, which cannot meet the requirements of technological progress and social development for the quality and abilities of engineering graduates. Due to the above reasons, graduates are unable to effectively apply their theoretical knowledge to solve specific production problems after employment, resulting in slow adaptation to the job[4-5]; Poor ability in innovation, reform, and project research, and insufficient development momentum.

The project-based teaching model is a creative way of learning that solves practical problems by guiding students to explore a real and complex problem, carefully designing a task, and other forms of teaching to cultivate students' knowledge and skills. The project-based learning teaching model has been extensively researched and applied abroad. For example, in the United States, project-based learning is one of the main learning modes for conducting research-based learning. Some universities in countries such as the UK and Singapore have also adopted project-based learning models.

The project-based learning model emphasizes the full cultivation of students' autonomy, innovation spirit, collaboration spirit, and ability to solve practical problems[6-7], which is in line with the development trend of higher

engineering education reform in China. It is a talent cultivation model worth learning and referencing for domestic higher engineering colleges in carrying out educational reform. However, project-based learning is a new type of learning model, and there are no ready-made projects for teachers to use, and there are relatively few cases that can be referenced. Especially in domestic university education, its application is rare. Therefore, when drawing on advanced training models from abroad for educational reform, it is necessary to combine the characteristics and conditions of the school to carry out project-based learning application research. This has important practical significance for promoting the application of this model and improving the teaching quality of computer programming courses.

In short, project-based learning is an innovative teaching model that conforms to the trend of modern education development. By combining theory with practice, it cultivates students' comprehensive and innovative abilities, and provides high-quality applied talents for society and enterprises. Applied universities should actively explore and practice project-based learning models to improve the teaching quality of computer programming courses and meet the demand of society and enterprises for software engineering applied talents.

2. Course Objectives

The overall objective of the teaching course is to enable students to systematically analyze the requirements of Android software, design and implement fully functional Android software systems, effectively deploy and maintain these systems, and play a key role in IoT engineering projects by studying the course of "IoT Android Application Development". Students should demonstrate innovative thinking, in-depth problem analysis, precise design and development of solutions, as well as proficient use of modern tools and professional ethics following engineering principles to meet the rapidly developing and diverse needs of the future IoT field.

(1) Quality objective: (a) Students should be able to evaluate the ethical and social impact of Android software in IoT systems, and demonstrate a sense of responsibility for technology applications and data privacy. (b) Students should be able to comply with industry standards and professional ethics guidelines, and demonstrate their abilities in teamwork, communication, and coordination. (c) Students should be able to identify innovative trends in the field of Android software and demonstrate their ability to explore and innovate in related areas.

(2) Knowledge objective: (a) Students should be able to describe the basic concepts, architecture, and key technologies of Android software, and be able to compare the applicability of different technical solutions. (b) Students should be able to demonstrate their application abilities in key technologies such as sensor data acquisition, wireless transmission, information processing, and software and hardware control. (c) Students should be able to explain the programming principles of microcontrollers and identify the core elements of Android software system design.

(3) Ability objective: (a) Students should be able to design and implement Android software systems, including selecting appropriate hardware components, writing program code, and integrating system functions. (b) Students should be able to deploy Android software systems for specific application scenarios and analyze and solve technical problems in practical applications. (c) Students should be able to develop IoT applications based on Android software and demonstrate their effectiveness in practical engineering projects.

3. Curriculum Reform Plan

(1) Combining teaching methods with task driven teaching methods. In classroom activities, the teaching method of lecturing is adopted to impart the basic principles and processes of Android software, ensuring that students master the necessary theoretical knowledge. At the same time, by combining laboratory operations and simulation software, using task driven teaching methods, students are guided to design and test Android software systems through practical operations, thereby improving their practical abilities and innovative thinking. In addition, through group projects and the application of collaborative learning teaching methods, students are encouraged to work together as a team to complete Android software design cases from concept to prototype, cultivating their collaborative spirit and project management skills.

(2) Action oriented teaching method and group discussion method. By adopting an action oriented teaching method and conducting on-site operations and case simulations, students are encouraged to personally install, configure, and monitor the Android software system. At the same time, using problem-based and discussion based teaching methods, organize students to practice fault diagnosis and improve their ability to identify and solve problems. In addition, through cooperative internship programs with enterprises, students can apply their learned knowledge and skills in real work environments, thereby deepening their understanding of Android software system maintenance and cultivating their professional ethics.

(3) Project based teaching method. For specific application scenarios, develop IoT applications based on IoT Android applications and demonstrate their application effects in actual engineering projects. Teachers should adopt project-based teaching methods to guide students to apply Android software to solve specific IoT problems through project-based teaching methods. By interacting with industry experts and collaborating with enterprises, using case-based teaching methods, students can understand market demand and technological trends, thereby enhancing their market awareness and innovation capabilities. At the same time, encourage students to participate in innovation competitions and technology exhibitions, and stimulate their innovative thinking and presentation abilities through brainstorming and subject based teaching methods.

(4) Case study teaching method. Incorporate discussions on engineering ethics and professional responsibility into the curriculum, using lecture based and case-based teaching methods to guide students in thinking about the impact of technology on society. By analyzing industry cases, students are made aware of the importance of adhering to professional standards. At the same time, in course assignments and projects, students are required to consider ethical and legal factors.

Teaching resources are not only an important part of extending and expanding teaching activities, but also a necessary condition for promoting teaching reform. High quality resources should be able to match the abilities and qualities required for the position, accurately align with industry standards, and from the perspective of learners, adopt platforms that meet their needs and learning characteristics,

and be as close to practical application scenarios as possible. Project based teaching resources aim to achieve complete engineering projects, reconstruct all knowledge points involved in engineering projects, including key and difficult points, and establish corresponding case resource libraries. Building high-quality teaching resources is the primary factor in ensuring students' learning stickiness and the cornerstone supporting teaching mode reform.

The reform of project-based teaching mode should be based on the characteristics of practicality, autonomy, development, comprehensiveness, openness, and evaluability in teaching. The process of implementing project-based teaching mainly includes the following five aspects:

(1) Clear project tasks: The teacher proposes tasks and classmates discuss them.

(2) Develop a plan: Students develop it, teachers review it and provide guidance.

(3) Implementation plan: Students are divided into groups and assigned specific tasks for collaborative completion.

(4) Inspection and evaluation: student self-evaluation, teacher evaluation.

(5) Archiving or application: Record archiving, apply practice.

Based on project-based teaching, we design a new teaching model of "learning knowledge outside of class and internalizing knowledge in the classroom". Students rely on modern information technology to play the role of self-directed learning, complete basic knowledge learning and raise difficult points before classroom learning. In the classroom, through student activities and teacher-student communication, we focus on solving difficult points to internalize knowledge. In terms of teaching mode design, the teaching process is divided into two modules: pre class and in class. Before class, students learn independently from the learning resources provided by the teacher. In class, students complete their learning through project-based learning scenarios created by the teacher, including independent thinking, collaborative learning, outcome communication, feedback and evaluation. Teachers have transformed from traditional knowledge transmitters to guides of learning activities, students have shifted from passive learning to active learning, and the classroom has shifted from knowledge transmission to problem-solving. Problem solving classrooms can better stimulate students' interest in learning and improve teaching effectiveness. The learning results are exploratory and personalized, emphasizing the training of students' ability and thinking, and reflecting the progressiveness and interactive nature of teaching forms.

4. Conclusion

The teaching reform of " Android Mobile Application Development " has systematically solved the core drawbacks of traditional teaching, which emphasizes theory over practice, knowledge over ability, and results over process, by optimizing teaching content, improving practical system, and innovating assessment methods. Teaching practice has shown that this reform plan can fully mobilize students' learning initiative, comprehensively enhance their programming practice ability, engineering literacy, innovative thinking, and teamwork ability, and significantly improve teaching quality.

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