Research and Design of Course Group Construction for "Web Development"

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Abstract: This article focuses on the construction of a course group for web development, aiming to enhance students' comprehensive skills and practical abilities in the field of web development through scientific and systematic course design and integration. Based on the analysis of current web development technology requirements, this article constructs a course system that covers modules such as technology development, project design, user experience design, and comprehensive project practice. The study adopts a modular design approach to classify and refine course content, and combines diversified teaching methods such as case teaching and project-based learning to explore strategies for improving teaching effectiveness and student participation. The research results provide theoretical support and practical reference for the construction of the web development curriculum system in universities.

Keywords: Web Development; Course Group; Project-Based Teaching; Software Engineering

1. Introduction

With the gradual maturity of the concept of computer software technology education, there is a deeper understanding of the talent cultivation mode and curriculum teaching mode for software developers. The construction of course groups and project-based teaching is not a new phenomenon in China, and the action oriented teaching model based on the work process is gradually being adopted by various higher education institutions. Especially in recent years, professional textbooks or tutoring materials have undergone "project-based" transformation, laying the foundation for the comprehensive promotion of project-based teaching in China[1].

The most important training target position for the Computer Science and Technology major is Web Development Engineer. In 2020, in order to transform the teaching method from traditional memorization knowledge oriented to project-based application ability oriented, this major attempted to construct a curriculum group and explore project-based teaching. The specific reform plan is to integrate the ideas of modular teaching and project-based teaching into the four professional courses of "Web Application Design", "Software Engineering", "Application Development Based on Framework Technology", and "Database Principles and Applications". By allowing students to independently complete their own web applications in strict groups according to the enterprise workflow in the classroom, students' comprehensive design ability, document writing ability, and code writing ability can be improved, while also enhancing their teamwork ability and learning enthusiasm[2]. Through in class feedback, symposiums, and experimental course results, it can be seen that students are more receptive to project-based and modular teaching content, and are full of interest in experimental content. The teaching objectives have been basically achieved.

2. Analysis of Current Teaching Situation and Purpose of Course Group Construction

2.1 Current Situation Analysis

The training goal of computer science and technology major is software engineer, but according to employment data, the implementation effect cannot achieve the expected goal. Although the experimental training hours of various courses have increased in recent years, there has been no significant improvement in teaching effectiveness[3]. The main reasons for this are as follows:

Firstly, the cultivation of software engineers requires more experimental training, and students cannot truly master the ideas and methods of software development through a single theoretical learning. In addition, the current experimental and practical training

programs mostly consist of small individual cases, which are not suitable for the actual work situation of enterprises[4].

Secondly, students are prone to feeling bored and uninterested in the abstract theories and memorization knowledge taught in the course. Due to a lack of project development experience, students find it difficult to connect abstract theories with the actual development process in their minds, making it challenging to develop an interest in the course content[5].

Thirdly, the assessment method does not pay enough attention to the process and practical aspects, which cannot meet the requirements of cultivating engineering and innovative talents The traditional teaching mode of software engineering mostly follows the textbook without real enterprise projects as support, which differs greatly from the actual development process of enterprise projects, such as no requirement changes, no plans, weak planning, and lack of review[6]. It cannot exercise students' logical thinking ability and ability to solve complex tasks in complex situations; In the stress free practical training mode, the quality of tasks completed by students is not high, and it is difficult to cultivate engineering awareness and standards[7]. In addition, the traditional knowledge training mode cannot achieve the cultivation of advanced professional skills such as communication and expression ability, analysis and problem-solving ability, stress resistance ability, and teamwork[8].

2.2 Purpose of Course Group Construction

The construction of course learning groups should start from the learning needs of students and focus on the following points:

Knowledge sharing and problem-solving: Web development involves a wide range of content, from the basics of HTML and CSS to front-end frameworks, back-end development, database management, and more. Students often encounter confusion and technical bottlenecks in their learning, and group discussions can effectively solve these problems.

Practical ability cultivation: Web development is a highly practical course, and it is difficult to achieve the course objectives solely through theoretical learning[8]. A well-designed learning community can provide practical projects for students, helping them apply what they have learned to real-life projects.

Teamwork ability: Modern web development projects often require teamwork, so it is particularly important to cultivate students' teamwork awareness and ability in course learning[9].

Learning motivation and sustainability: The design of the group should provide incentive mechanisms to keep students motivated and avoid falling behind in the learning process[10].

3. Course Group Design

Select three professional courses, namely "Web Application Design", "Software Engineering", "Framework based Application Development" and “Database Principles and Applications”, to form a course group and conduct project-based teaching to enhance students' comprehensive application abilities.

3.1 Course Introduction

The teaching content of "Web Application Design" aims to enable students to master the workflow and general principles of prototype design, interface design, architecture design, interface design, database design, development process design, project configuration design, and other aspects in the process of web application design. If not combined with practical projects, the teaching content of this course is only some boring memorization knowledge, which is difficult to arouse students' interest.

The teaching of the course "Software Engineering" mainly relies on teachers explaining engineering methods (development methods), tools (tools supporting methods), and processes (management processes) in the classroom. The course content is relatively abstract, and students find it difficult to understand and accept due to a lack of engineering practice. In the experimental class, the teacher requires students to practice more hands-on, and most of the practical content is provided by the teacher as reference materials for software engineering. Students write some documents according to the materials, but lack independent analysis and thinking. They believe that software engineering courses are only about completing document writing, without a deep understanding of the true meaning of software engineering, and the teaching effect is difficult to achieve the teaching objectives of software engineering courses.

The teaching content of "Application Development Based on Framework Technology" is to explain the principles of using framework

technology to implement WEB information systems, teach a commonly used framework technology in the industry, and explain the production process of some small cases around the relevant knowledge points of this framework technology. During the experimental hours of the course, the teacher will ask students to do some exercises, similar to the small cases explained in class. Through the course, students can learn the basic knowledge points of web application development, but they have no understanding of the actual development process, application design ideas, team collaboration tools, and other skills that enterprises are concerned about.

The training objective of the course "Database Principles and Applications" is to enable students to master the basic principles, design methods, and practical application skills of database systems, understand core concepts such as data models, relational database design, SQL language and its optimization. Through this course, students will have the ability to design and manage databases, effectively use database management systems to solve practical problems, and support the development and maintenance of application systems. In addition, the course also focuses on cultivating students' abilities in data processing, analysis, and standardized data operation, laying a solid foundation for their further learning and work in fields such as information management and software development.

3.2 Project Oriented Design

From the analysis of the current teaching situation of the above courses, it can be seen that the reason why the teaching effect is not as expected is that students lack experience in software development and find it difficult to understand and appreciate the significance of learning course knowledge. The project-based teaching method can provide a solution for this situation, which is to create an environment for students to develop projects, simulate enterprise software development job tasks, change students' roles, and apply course knowledge to the design and development process of software projects according to the requirements of their professional positions. Students can experience job work and complete project development, and the entire development process is also a process of gaining knowledge and improving professional abilities.

Therefore, the first step in this project-based teaching reform is to select suitable projects, with the software development process as the main line, focusing on the various stages of enterprise level project development, to achieve the transformation of the roles of teachers and students in the teaching and learning process, so that students can immerse themselves in the experience, stimulate their thirst for knowledge in the role experience process, fully exert their learning autonomy, and reflect the combination of vocational adaptability and vocational transfer ability in vocational ability cultivation. During the project development process, the teaching and research group requires students to follow the code of conduct of project managers and developers to complete the development and management process of enterprise level projects. At the same time, the project management platform is used as a support to carry out process management of each stage of project development, establish a standardized document review and assessment mechanism, realize the "engineering" transformation of project-based teaching, and establish a teaching system that combines engineering practice and theory. Practice has proven that this is a highly effective teaching reform method.

3.2.1 Course design ideas

The basic design concept is centered on cultivating vocational abilities, with the goal of improving students' comprehensive vocational literacy. Based on vocational job tasks, project-based teaching integrates course content with enterprise work tasks, highlighting the characteristics of the course's professionalism, practicality, and openness. In this practice, the teaching and research group followed the enterprise software development process for course content based on the job tasks of the professional position. The instructor reconstructed the course content according to the project and organized the knowledge points based on the reading of the textbook, and designed learning tasks.

3.2.2 Design of project-based teaching activities

Project selection: The teaching and research group selects suitable graduation project topics from previous years as students' practical training projects. Each project is required to combine theoretical knowledge and practical skills, and be comprehensive. Project implementation requires learning new knowledge and skills, and solving practical

problems that have not been encountered in the past.

Task release: The teacher distributes the project task book to the students, allowing them to freely group and receive tasks. After consultation with the teacher, the members and roles of each group are determined. The number of members in each project group is divided according to the workload of the project, which is estimated based on the number of modules used in the web application. The entire development process has cultivated everyone's teamwork ability, which is not only beneficial for students to showcase their strengths, but also helps to form their sense of responsibility and collaborative spirit, experiencing the joy of personal and collective growth together. The following is a list of roles involved in the project.

Requirement analysis: The teacher teaches the process and key points of conducting requirement interviews and requirement analysis in the "Software Engineering" classroom. Students form requirement interview forms for their respective modules, which are summarized by the product manager and interviewed by customers to form interview records. Students will then establish a requirements analysis model and related charts such as data flow diagrams, use case diagrams, flowcharts, etc. based on the knowledge they have learned, to form a requirements analysis manual. On the basis of the requirements analysis manual, students extract the functional points of each module, complete the functional descriptions of each functional point, and finally summarize them into the requirements specification manual. In the "Web Application Design" class, teachers will work with students to complete requirement review and reach a consensus on understanding the requirements.

Prototype design: The teacher teaches the process and key points of using Azure and other tools to design system principles in the "Software Engineering" class. Students design prototype pages for each module, and the product manager designs the homepage, menu, etc. to combine the modules together to form a system prototype. In the classroom of "Web Application Design", each group demonstrates the system prototype, and the teacher reviews the system prototype, points out the problems, and requires students to improve important documents such as the requirements analysis manual, requirements specification manual, and system prototype. The process of improving requirements is also a process for students to deepen their understanding of the system.

Test case design: Teachers teach the process and key points of software testing, as well as the writing standards of test cases in the "Software Engineering" classroom. Students complete functional test cases for each module based on the knowledge they have learned, and evaluate the test cases in the "Web Application Design" classroom. Through the evaluation process, students will clarify the quality standards that the system will achieve.

Interface design stage: The teacher teaches the design points and required tools of interface design in the "Framework based Application Development" classroom. Students apply their learned knowledge to transform the system prototype into a static page.

Interface design stage: The teacher teaches the process and key points of software interface design in the "Web Application Design" classroom. Students apply their learned knowledge to determine the front-end and back-end interfaces, as well as the interfaces between various modules, and complete the system interface design manual. In the "Web Application Design" class, teachers will work with students to complete the interface design review. Through the evaluation process, students will clarify the interface functions of each module.

Database design stage: The teacher teaches the process and key points of database design in the classroom of "Database Principles and Applications". Students apply their learned knowledge to complete the tables and fields of each module, combine them into a system ER diagram, complete the database design manual, and ultimately generate the database.

Architecture design stage: In the "Software Engineering" classroom, teachers teach about software architecture design and knowledge about design patterns. Students need to integrate all the design work they have completed before to form a brief design specification for the system.

Code design stage: The teacher teaches how to use framework technology for front-end and back-end program writing in "Framework based Application Development", and teaches object-oriented code design ideas, software development processes, and code coding standards in "Software Engineering". Students

complete the code structure of each module according to the knowledge they have learned, while writing comments on the code. At this stage, the project team needs to complete a detailed system design specification.

3.2.3 Course evaluation

The teaching and research group believes that students' regular grades are composed of attendance in each course (50%) and classroom performance (50%), accounting for 40% of the total grade, reflecting students' sense of responsibility and discipline; The final grades of each course consist of team grades (50%) and individual grades (50%). Four students from each project team played special roles, and their work demonstrated their organizational and management abilities. In this practice, teachers will give extra or extra points based on the completion level and quality of their special tasks.

4. Implementation Steps for Building a Course Group for Web Development

4.1 Group Formation and Role Training

Group students according to their interests and technical level, help them choose suitable roles, and provide role training to ensure that they have the basic ability to complete tasks.

4.2 Task Allocation and Goal Setting

Assign learning tasks, set project goals and deadlines. The task arrangement should take into account the differences in students' levels, ensuring that the tasks are challenging but not beyond their abilities.

4.3 Teacher's Explanation and Analysis

Teachers of each course use their class time to provide comprehensive explanations and analysis based on the project content, guiding students to implement the project. This step requires teachers to have sufficient communication with each other to ensure that the content in the course is not repeated but fully covered.

4.4 Online Collaboration and Real-Time Feedback

By using online collaboration tools and task management platforms, real-time communication, task allocation, and feedback among team members can be achieved to enhance the efficiency of group collaboration.

4.5 Project Evaluation and Presentation

After the project is completed, evaluate and showcase the projects of each group, encourage them to share project experience, summarize learning gains, and improve the project based on feedback from the supervisor.

5. Effectiveness and Feedback on the Construction of Web Development Course Groups

5.1 Enhancing Students' Practical Abilities

Through a project driven learning model, students are able to effectively apply classroom knowledge to projects, significantly improving their practical development skills. After the course, students not only mastered basic web development skills, but also accumulated rich project experience.

5.2 Enhancement of Teamwork Awareness

Group cooperation and role rotation cultivate students' teamwork ability, enabling them to learn how to coordinate and communicate in a team through practice, and effectively solve division of labor and cooperation problems in project development.

5.3 Enhancement of Learning Motivation

By setting phased goals and reward mechanisms, students' motivation in the learning process is significantly improved. The support and feedback that students receive in the group make them more motivated to continue learning when facing difficulties.

5.4 Enhance Professional Competitiveness

Project experience provides students with practical vocational skills accumulation, enabling them to have preliminary vocational competitiveness, which is helpful for showcasing skills in internships and employment.

6. Conclusion

The application practice of project-based teaching has shown that project-based teaching emphasizes cultivating students' practical abilities as the goal, integrating subject knowledge into projects, using selected projects as carriers, decomposing projects into various tasks, and combining theory and practice. The teaching process is task driven, and students exercise their analytical thinking and problem-

solving abilities, cultivate teamwork spirit, and improve team communication skills through teamwork to complete tasks. This method is beneficial for students to understand the job tasks of professional positions in enterprises and master the process of software project development. Classroom teaching is no longer dull and boring, free from theoretical indoctrination, fully tap into students' learning autonomy, promote the role transformation of students from learners to professionals, and highlight the cultivation of students' professional abilities.

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