

Project-based Learning Research: A Case Study of “Web Programming Semester Practice” Course

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Abstract: Project-based learning, as a novel pedagogical approach, can effectively address the disconnect between acquired knowledge and real-world problems. By creating authentic problem-solving scenarios, designing interconnected physical problems, and leveraging modern information technology, teachers can facilitate student-centered learning activities. In the implementation of project-based learning, experiments serve as a vehicle to guide students in autonomous, collaborative, and experiential learning. This teaching method not only enhances students' learning interest, but also improves their practical skills and innovative abilities. This study takes the “Web Programming Semester Practice” course as an example to explore the application of project-based learning in web programming instruction, aiming to address the shortcomings of traditional teaching methods and improve the quality of web programming courses. The findings of this study have significant theoretical and practical implications for promoting the reform of web programming teaching and enhancing students' practical skills and innovative capabilities.

Keywords: Project-based Learning; Web Programming; Instructional Guidance; Autonomous Learning

1. Introduction

1.1 Research Background

With the rapid development of internet technology, web programming has become an indispensable skill in today's society. As a crucial course in computer science, the web programming semester practice course plays a significant role in cultivating students' practical skills and innovative abilities. However,

traditional teaching methods often suffer from several problems, such as neglecting the complexity of real-world problems, lacking the cultivation of students' collaborative abilities, the disconnect between experimental processes and real-world problem scenarios, the lack of connections between knowledge, and the overly simplistic evaluation process^[1]. These issues have seriously affected the teaching effectiveness and urgently need to be addressed.

1.2 Research Objectives and Content

The purpose of this study is to explore the application effects of project-based learning in web programming semester practice courses, aiming to enhance students' learning motivation and autonomous learning ability. The main content of this research will focus on the following aspects:

- (1) The basic concepts and theories of project-based learning, as well as its practical application in web programming semester practice courses.
- (2) Specific implementation strategies and methods of project-based learning in web programming semester practice courses, including teaching design, organization, and evaluation.
- (3) Case analysis of the practical application of project-based learning in web programming semester practice courses. By conducting in-depth analysis of these cases, the advantages and disadvantages of project-based learning in actual teaching can be summarized.
- (4) Based on the application of project-based learning in web programming semester practice courses, this study explores how to improve students' learning motivation and autonomous learning ability, as well as how to promote students' overall development.

Through the research on these aspects, this project aims to provide theoretical support and practical guidance for the teaching reform of

web programming semester practice courses, so as to improve students' learning outcomes and quality. At the same time, the research findings of this project will also provide reference for the teaching reform of other courses, promoting the reform and development of education and teaching methods in China.

1.3 Research Methods

This study adopts a combination of literature review and case study methods to delve into the application of project-based learning in undergraduate courses, with a particular focus on analyzing the specific application of project-based learning in web programming practice courses.

2. Teaching Contents of Web Programming Semester Practice

2.1 Course Overview

The “Web Programming Semester Practice” course is designed for computer science and technology students to help them master the fundamental skills of web programming and enhance their practical programming abilities. The course is set against the backdrop of the widespread application of web applications, including websites, applications, and mobile applications, making web programming an essential skill for computer science and technology students.

The goal of this course is to enable students to independently develop web applications, understand the basic structure and functions of web applications, including web development technologies such as HTML, CSS, and JavaScript, and learn how to use web development frameworks and libraries to rapidly build web applications.

2.2 Course Content

The core curriculum revolves around guiding students through the completion of a concrete web development project. By replicating an e-commerce website, students will gain a deep understanding of the applications of HTML, CSS, and JavaScript.

2.3 Teaching Methods and Approaches

In the “Web Programming Semester Practice” course, project-based learning will be adopted as the primary teaching method. This approach emphasizes student autonomy, collaboration,

and student-centered learning, focusing on cultivating students' initiative and exploratory abilities. Compared to traditional teaching methods, project-based learning can better stimulate students' interest in learning and enhance their practical skills and problem-solving abilities.

Firstly, we will adopt a problem-driven teaching approach. At the beginning of the course, we will present a real-world web development project and guide students to gradually solve this problem through independent learning and collaborative exploration. This approach can stimulate students' interest in learning and motivate them to actively learn and master relevant knowledge while solving problems.

Secondly, we will utilize a variety of teaching tools and methods to assist in instruction. For example, we will leverage the abundant learning resources available on the internet, including video tutorials, online discussions, and online Q&A sessions. These teaching tools can help students learn anytime and anywhere, improving learning efficiency.

Finally, we will provide active guidance to students, encouraging them to independently learn and explore related technologies. This will help students better understand web development technologies and methods, and improve their practical abilities.

3. Implementation of Project-Based Learning in “Web Programming Semester Practice” Course

3.1 Steps in Implementing Project-Based Learning

Project-based learning is an innovative teaching method that emphasizes integrating learning content with real-world projects to enhance students' practical skills and innovative abilities^[2]. In this section, we will use the “Web Programming Semester Practice” course as an example to elaborate on the steps of implementing project-based learning.

First, the teaching process is the core of project-based learning. The teaching process typically includes the following steps:

1) Defining Learning Objectives: Before starting the course, the instructor needs to clarify the learning objectives, that is, the learning goals that students are expected to achieve after completing the project. These objectives should be closely related to the course content and be

able to stimulate students' learning interest and motivation. The main teaching objectives of this course are to enable students to master the basic knowledge and applications of HTML, CSS, and JavaScript related to web development, and to be able to solve basic problems encountered in learning and development independently. At the same time, to stimulate students' interest in learning, so as to achieve the goal of improving learning effect and teaching quality.

2) Designing Project Tasks: Based on the learning objectives, the instructor needs to design a series of specific project tasks. These tasks should be challenging and feasible, and allow students to learn through practice^[3]. The teaching task of this course is relatively basic, and students only need to complete a basic static page. Of course, teachers need to guide students to carry out innovative thinking in the teaching process and achieve some effects beyond the plan.

3) Providing Guidance to Students: The instructor needs to guide students in completing the project tasks. This includes providing necessary knowledge and skills, answering students' questions, and providing feedback and suggestions.

4) Evaluating Student Performance: The instructor needs to evaluate students' project tasks to understand students' learning progress and outcomes. Evaluation methods can include oral presentations, code reviews, and tests.

Secondly, teaching organization is also a crucial component of project-based learning. Teaching organization should ensure that students can effectively complete project tasks. This includes:

1) Organizational Structure: Project-based learning typically adopts a group collaboration format, where students are divided into several groups to complete a project together. Teachers should provide each group with the same resources and conditions to ensure fair competition.

2) Teaching Resources: Teachers should provide students with sufficient teaching resources, including textbooks, reference books, and online resources. These resources should help students better understand the project tasks and provide necessary support^[4].

3) Learning Environment: Teachers should provide students with a good learning environment, including a quiet learning space, appropriate equipment, and tools. These environments should be able to stimulate

students' learning interest and motivation, helping them better complete project tasks.

3.2 A Case Study of Project-Based Learning in the Course

In the "Web Programming Semester Practice" course, we adopted a project-based learning approach to enable students to acquire web programming skills through practical experience. The following is a specific case study:

The primary objective of this course was to equip students with the ability to design and implement a simple e-commerce website, including modules such as navigation bars, advertising banners, promotional sections, main product displays, and copyright notices. Within the framework of project-based learning, we first set a clear project task, which was to replicate the e-commerce website. This task not only encompassed the core content of the course but also possessed a certain degree of interest, capable of stimulating students' learning interest and motivation.

During the project-based learning process, we began with the preparatory work for the modular project, including formulating plans, assigning tasks, and learning fundamental theoretical knowledge points. In the middle stage of the modular project, students started to undertake specific design and implementation work. They needed to utilize their acquired web programming knowledge to conduct systematic analysis and design based on the project requirements. In the later stage of the modular project, students summarized and analyzed the completed project, discussed and resolved problems encountered during the project, and ultimately delivered the final project.

Through this application case of project-based learning, we can observe the significant effects of project-based learning in the course. Firstly, project-based learning can enhance students' learning interest and motivation, making them more proactive in the learning process^[5, 6]. In the process of completing the project, students can not only master the core knowledge of the course but also cultivate their practical operational abilities and teamwork skills. Secondly, project-based learning can effectively improve students' learning outcomes, enabling them to better understand and grasp knowledge in practice. Finally, project-based learning can stimulate students' innovative thinking, allowing them to discover problems and seek solutions in

practice.

3.3 Analysis of Students' Learning Situation

This course is for students in the first semester of junior year majoring in software engineering. Students have learned C language programming, object-oriented programming, operating system and data structure and other computer courses in the early learning process, and have a certain foundation of programming. However, they have not systematically learned the relevant knowledge of software development, and lack the comprehensive application of relevant knowledge points, so the overall level of students is poor

3.4 Analysis of the Effectiveness of Project-Based Learning in the Course

Firstly, from the perspective of student learning outcomes, nearly 99% of students in the class were able to actively participate in the teaching process, achieving goals such as “putting down their phones” and “looking up” in class.

Secondly, in terms of teaching effectiveness, most students were able to independently complete corresponding tasks and combine them into modules based on the teacher's explanation, demonstrating the superiority of project-based learning in promoting learning through practice compared to traditional teaching methods.

However, the analysis of the effectiveness of project-based learning in the course also needs to pay attention to some issues. For example, project-based learning requires students to have strong independent learning abilities and problem-solving skills, which can be a challenge for some students. Additionally, project-based learning requires teachers to have certain guidance and organizational abilities, which can also be a challenge for teachers. Therefore, how to ensure teaching effectiveness while taking into account individual differences among students is a question that requires further research and discussion.

4. Improvements and Suggestions for Project-Based Learning in Web Programming Courses

4.1 Design of Course Content

When designing the course content, it is recommended to choose relatively simple cases. In this way, students can complete corresponding tasks through some simple

learning, which can effectively stimulate students' learning enthusiasm.

4.2 Improvement of Teaching Methods and Means

In terms of teaching methods, in addition to the basic methods of traditional project-based learning, more guidance can be provided to students. Specifically, while completing the assigned tasks, some attractive functional modules can be added to guide students to engage in independent learning. In the implementation of this course, some students have added some functions on their own while completing the e-commerce website, such as one-click skin switching and image switching effects. These effects can be very attractive to students, guiding them to engage in independent learning and stimulating their creativity.

4.3 Improvement of Teaching Tools

In the teaching process, in order to improve the actual teaching effect of the course, teachers need to prepare the teaching resources required for the course in advance to help students conduct relevant information inquiries. In this project-based teaching practice, the teacher adopted the form of an experimental guide to guide students' actual operation process. However, during the actual operation, some students with lower learning autonomy directly followed the experimental guide, lacking their own thinking. Therefore, it is considered to add loose-leaf textbooks as teaching tools in subsequent teaching. In each class, the content to be learned and the tasks to be completed in this class are clearly stated, and the specific implementation steps and methods are not provided in the textbook, guiding students to learn independently throughout the process.

4.4 Improve Classroom Assessment Methods

In addition to the traditional presentation of results, students' learning process and outcomes can be comprehensively evaluated through oral reports, written reports, and outcome papers. At the same time, multiple evaluation methods such as teacher evaluation, group mutual evaluation, student self-evaluation and real reader or audience evaluation are introduced to ensure the objectivity and comprehensiveness of evaluation. Pay attention to students' performance and effort in the project implementation process, and give timely feedback and guidance. Through process

evaluation, students are helped to find deficiencies and improve learning methods.

4.5 Enrich Curriculum Learning Resources

Provide students with a variety of learning resources, including network resources, field resources, social resources and so on. These resources can help students better understand and complete project tasks. Integrate all kinds of learning resources and establish learning resource library to facilitate students to find and use relevant resources at any time.

5. Conclusion

In practical application, this research found that the project-based teaching method in the “Web Programming Semester Practice” course can effectively stimulate students' learning enthusiasm and tap into their inner potential. It can also cultivate students' innovative spirit and teamwork abilities. Through the verification of practical teaching, the curriculum reform of this research has served as a demonstration for the curriculum reform of the entire major and laid the foundation for the construction of other application-oriented curriculum systems in computer science.

Through the study of the “Web Programming Semester Practice” course, this research concludes that project-based learning is a learning mode driven by projects and guided by tasks, which can effectively improve students' practical abilities and innovative spirit, and at the same time cultivate students' teamwork abilities. However, the following points need to be noted in the implementation process:

(1) The selection of projects or teaching cases should ensure that the project has a certain attractiveness to students, only after students have their own interest in it can better conduct independent learning;

(2) In the teaching process, we should pay attention to the guidance of students, not simply arrange tasks for students to complete the whole process, nor teach a lot of knowledge points like traditional teaching. It is better to divide the complete teaching project and process into

multiple parts, and pay attention to raising questions in each part and let students solve them by themselves;

(3) In-depth guidance can be given to students after the completion of the course, such as what they can do after learning relevant knowledge and what more in-depth knowledge they can learn. This part of guidance will have a certain impact on students' future development.

References

- [1] Lu Di, Li Su, Liu Shengzhi, et al. Application and Practice of Project-Based Learning in the Course "Python Programming Design". *Technology Wind*, 2024, (27): 120-122. DOI:10.19392/j.cnki.1671-7341.202427040.
- [2] Li Qiaonan, Wang Jiamei. Exploration and Practice of the Integration of Online and Offline Interactions in Flipped Classroom and Project-Based Learning. *Green Packaging*, 2024, (09): 57-61. DOI:10.19362/j.cnki.cn10-1400/tb.2024.09.011.
- [3] Fan Shengbo, Yu Xiaoran, Zhang Chao, et al. Project-Based Learning Practice Based on the Integration of Industry and Education. *Journal of Higher Education*, 2024, 10(27): 122-125. DOI: 10.19980/j.CN23-1593/G4.2024.27.029.
- [4] Zhang Jinhuan. Construction of Project-Based Course Teaching Quality Evaluation System in Colleges and Universities Based on the CIPP Model. *China Journal of Multimedia & Network Teaching (First Issue)*, 2024, (06):120-123.
- [5] Shi Hao, Wang Dong, Yu Jian, et al. Research and Practice of Project-Based Autonomous Inquiry Teaching Model. *Journal of Electrical & Electronic Education*, 2023, 45(06):218-223.
- [6] ZHANG Lei, Li Jing, Wang Bin, Zhang Xu. Research and exploration on project-based teaching of Computer majors in local universities. *Science and Technology Horizon*, 2018, (08):38-39.