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Research and Practice of Blended Teaching of Web Front-end Development Course Oriented by Competency Based Education

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Abstract: *This study, grounded in the concept of competency-based education, undertakes a comprehensive investigation into the web front-end development industry to identify the essential occupational competencies and humanistic qualities needed for these roles. Focusing on the "Web Front-end Development" course in higher vocational education, the study strategically selects and plans course projects, incorporating them into a blended teaching model that integrates both online and offline methods. This approach not only addresses the practicalities of the course but also effectively bridges the gap between educational training and industry requirements. The course projects are decomposed into smaller, manageable tasks, enabling students to acquire professional skills and humanistic qualities through active engagement and practical application. The study further evaluates the impact of this teaching model, offering valuable insights for the implementation of competency-based project teaching in higher vocational computer courses, particularly in the context of the current informational era. The findings suggest that this model significantly enhances students' professional competencies and fosters a deeper integration of work and learning, thereby aligning more closely with the evolving needs of the industry.*

Keywords: *Competency Based Education, Blended teaching, Project-based teaching, Front-end development*

1. Introduction

The rapid development of electronic information technology requires the knowledge and skills of related practitioners to be updated quickly. Computer courses in higher vocational education are facing the challenge of rapid iteration of subject knowledge. The traditional project-oriented teaching model has made significant progress in theoretical research and practical application and has been widely recognized and applied. [1] The concept of competency-based education has also been widely accepted in the field of vocational education in China, but due to the limitations of traditional educational ideas and the conditions of higher vocational education, there are still some problems in the cultivation of professional abilities based on competency orientation. [2] The development of the Internet and information technology era calls for a change and upgrade of project-based teaching. At present, vocational colleges in China should fully understand the local characteristics of vocational education, recognize the essence of competency orientation, strengthen the close cooperation between schools and enterprises, reform the traditional discipline-oriented teaching model, and cultivate skill-oriented talents that meet the needs of society.

2. Competency-based Project-based Teaching

The concept of competency-based education (Competency Based Education, referred to as CBE) originated in the field of vocational education and training in the United States in the 1960s, with its core being to carry out teaching work based on the job capability requirements obtained by job analysis. [3] CBE emphasizes the importance of learning outcomes, that is, the abilities and skills that students should possess after completing their studies. This educational concept has been widely applied and developed in different countries and regions, especially in the field of vocational education. Dutch higher vocational education has accumulated a lot of advanced experience in cultivating vocational skill talents by adopting a project-based teaching model in the implementation of competency-based education, highlighting job position capabilities, and taking into account the continuity and integrity of knowledge. The

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disconnection between school education and enterprise needs is an important aspect leading to the difficulty of student employment.

Competency-based project-oriented teaching is an educational model that focuses on the cultivation of students' abilities, conducting teaching activities through the form of project tasks. This educational model emphasizes that specific operational projects act as the bridge connecting schools and enterprises, theoretical knowledge and working practice requirements, as well as part-time teachers in enterprises and full-time teachers in universities, thereby achieving the close integration of education and the demands of practical working ability. [4] In this way, it is hoped to solve the disconnection problem between school education and enterprise needs, and enhance students' employability and professional skills. In the process of competency-based project-based teaching, the curriculum design is centered on the actual needs of the industry and enterprises, organizing the professional talent training plan in a project-driven manner, allowing students to deeply understand and master professional knowledge and vocational skills by completing specific project tasks, thereby achieving the integration of work and study.

3. Teaching Restructuring of "Web Front-end Development" Course

With the rapid development of information technology, web front-end development has become an extremely important branch in the field of information technology. There are many employment choices for web front-end development positions, and the career path is broad. However, there are still many problems in the construction of related professional courses in vocational colleges. Through in-depth analysis of the feedback from graduates of this major and the records of teacher interviews, it has been found that the professional course content is too focused on imparting subject knowledge, resulting in scattered and complicated knowledge points. Although teachers have adopted case teaching methods in teaching, students often feel confused after mastering many cases, and do not know how to apply the knowledge they have learned to actual work. The teaching strategy has not fully cultivated students' ability to adapt to actual job positions, which may be one of the reasons why the number of graduates choosing to enter the front-end development industry is relatively small. [5]At the same time, with the rapid development of HTML5 and its related technologies (including HTML5, CSS3, JavaScript, referred to as H5), the mobile terminal market is rapidly becoming the main platform for information display, and the job position requirements for web front-end development have also shifted from traditional PC web page design and production to a more comprehensive front-end development that takes into account more devices, especially mobile devices. The "Web Front-end Development" course offered by higher vocational computer-related majors in China also needs to adjust the course teaching content and mode in time to cultivate skill-oriented talents that meet the job requirements.

This course is aimed at students in higher vocational colleges, who generally have a good foundation in information technology application, prefer practical teaching, and have a certain aesthetic and design ability. The students in their second year are familiar with each other, which provides a good foundation for the smooth conduct of team collaboration activities. In the field of programming, students have relatively weak basic knowledge, and their coding habits also need to be further standardized and improved. Because they are more inclined to practical operations and are not sensitive to abstract theoretical concepts, they often lack patience and interest in in-depth exploration when facing the study of theoretical knowledge.

The overall objective of this course is to familiarize students with the web page design process and to master common web page layout methods through professional theoretical knowledge teaching and operational skills training, enabling them to create various types of corporate, portal, and e-commerce websites. Traditional course teaching is organized around knowledge points, with teachers lecturing on knowledge points and teaching cases in the sequence arranged by textbook chapters. Students' learning tends to be fragmented, making it difficult for them to independently develop complete projects, which is not conducive to establishing a sense of achievement in learning. Project-based teaching is a widely adopted teaching method in vocational colleges, and whether the teaching projects match the job position ability requirements of graduates is key to the effectiveness of teaching. In the course "Web Front-end Development," there are numerous HTML5 tags and CSS3 style properties. Most textbooks, including some project-based textbooks, are arranged in the order of tags. When facing the study of theoretical knowledge, students often lack the patience to persist and the interest to explore in depth.

The course conducts on-site research in enterprises to accurately understand industry needs and job requirements, ensuring the timeliness and relevance of course content. The course design is "oriented by competency, taking vocational practice as the main line, and taking project courses as the main body",

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[6] breaking the traditional subject system model, and organizing the course content into five typical website construction projects with increasing difficulty: Classic Ancient Poetry Website, Personal Studio Website, World News Network, City Tourism Website, and Corporate Portal Website. Each project represents a complete web site design and development process. The development of the three projects progresses from simple to complex, aligning with the cognitive patterns of students, with the understanding of knowledge and mastery of skills spiraling upwards. Each project is divided into several work tasks according to the development route, from the realization of single functions to the comprehensive optimization of the project, allowing students to learn to expand the project with personality on the basis of realizing the basic modules of the website, and achieve the synchronous improvement of students' knowledge level and practical ability. [7]

4. Teaching Strategies and Methods of the Course

The teaching content of this course is not only numerous but also the knowledge points are intertwined and complex, requiring a large number of project practices to help students understand and master. Due to the limited number of teaching hours and the large number of students in offline classrooms, teacher-student interaction is hindered. Combining informationization with traditional classroom education, using the Superstar online course platform, Superstar Learning APP, CSS Battle and other game websites, a large number of online video tutorials, and multimedia teaching platforms in the computer room to carry out online and offline blended teaching can break the limitations of classroom time and space. By using the online teaching system, teachers can track students' learning progress in detail. The system is equipped with an efficient attendance function, which significantly reduces the time teachers spend on roll calling. When students download learning materials and complete assignments on the platform, they will receive corresponding points, which not only stimulates students' enthusiasm for learning but also allows teachers to understand students' detailed situation in pre-class preparation and post-class review in real time. [8]

The task-driven teaching method is adopted, which breaks down large projects into small tasks, allowing students to master knowledge points and consolidate what they have learned in actual operations by completing specific tasks. Encouraging students to work in teams and complete project tasks together aims to enhance students' collaborative and problem-solving abilities. Using game websites such as CSS Battle for teaching the knowledge of the box model, in the form of games, can improve students' interest in learning and let students explore learning in the game. Through practical operations, team cooperation, and gamified learning, students can more effectively master complex knowledge points and improve learning interest and efficiency. At the same time, teachers will provide personalized guidance and support to help students gradually establish standardized coding habits, improve their programming ability, and deepen their understanding and application of theoretical knowledge through practical activities.

5. Teaching Analysis of the "CSS Box Model" Unit

The "CSS Box Model" teaching unit is the first teaching unit in the third teaching project "World News Network." Through the teaching of the first two projects of the course, students have mastered the use of commonly used HTML tags, have learned to use basic CSS style properties to design and beautify web pages, and have a certain coding foundation. Subsequent to the teaching content of CSS floating, CSS positioning, and element type and conversion, learning this unit content will lay a solid foundation for the development of this project.

In teaching practice, facing the challenges that students generally face in understanding concepts, teachers can use the "package box" commonly seen in life as a teaching tool, and help students form an intuitive understanding through analogy. This teaching strategy replaces the traditional theoretical teaching method by breaking down actual cases into several easy-to-handle small tasks. It encourages students to explore preliminarily according to the tasks assigned by the teacher, and to get immediate guidance from the teacher when encountering challenges. Once students have a thorough understanding of the basic concepts, they will carry out in-depth exploration and application. In the final stage of the class, students will sort out and strengthen the knowledge they have learned through review and extension exercises to ensure that they have a solid grasp of it. [9] In teaching, teachers can make full use of various activities of the online course platform to optimize classroom interaction and grasp the teaching progress at any time. They can also skillfully use gamification teaching to enhance students' interest in learning, focus on key and difficult points, and highlight repetitive exercises of core skills, so as to improve

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learning efficiency. [10]

6. Implementation of the "CSS Box Model" Unit Teaching

6.1. Pre-class Preparation Phase: Information Acquisition and Pre-class Test

In the pre-class preparation phase, the teacher's activities are mainly focused on arranging pre-study tasks, uploading teaching courseware, screen recording micro-courses and other learning resource packages through the Superstar Learning platform, and initiating test activities on the platform. These activities aim to help students preliminarily understand the composition of news websites and the basic concepts of the CSS box model, as well as the setting methods of related attributes, through self-study, and to fully mobilize students' self-learning ability and initiative, so that students can have a general understanding and preliminary understanding of the content to be learned before classroom teaching, thereby improving classroom efficiency. At the same time, through pre-class tests, teachers can timely understand students' learning foundations and pre-study situations, and adjust teaching strategies and content at any time.

6.2. Classroom Implementation Phase

6.2.1. Review of Old Knowledge and Introduction of New Lessons

At this stage, the focus of the teacher's activities is to analyze the completion of pre-class test questions and review the knowledge that has been learned (such as the representation of colors in CSS, the cascading and priority of CSS) to provide a background for the new lesson content. At the same time, typical news web page layouts and the page effects of this unit's "World News Network" are displayed to stimulate students' interest in new knowledge and provide a visual reference for them to understand new knowledge. The main activities for students in this link are to analyze the "World News Network" page and use software or hand-drawn sketches to draw the wireframe diagram of the web page, which can better understand the overall and local relationship of the web page layout, and prepare for the in-depth study of "CSS Box Model" and its application in web page design.

6.2.2. Concept Introduction and Clarification of Objectives

The concept introduction phase is crucial as it helps to clarify learning objectives and provide direction for students. By asking questions, telling related stories, or presenting real-life examples, it stimulates students' interest and curiosity, guiding them to think about the topics they are about to learn. For example, by comparing the familiar mobile phone packaging box, the concept of the box model is introduced, helping students to establish the box thinking in the web page and understand the nested relationship. By showing the importance or value of the concept in practical application, it enhances students' motivation to learn. Students discuss in groups and answer how to understand the "CSS box model" and clarify that this unit needs to complete the production of the "Hot Recommendation" column.

6.2.3. Game Teaching and Self-Exploration

The teacher selects appropriate game levels related to the box model from the game website and supervises the students' learning process, understanding their completion and the problems they encounter, and provides timely guidance. Students attempt to complete the challenges in the game in groups, such as the production task of the right-side content box of "Hot Recommendation". Students can consult the materials provided by the teacher, analyze and discuss difficult points, and record them. Using the teaching method of combining education with entertainment, it arouses students' enthusiasm for learning, and assists students in actively exploring, analyzing, and finding strategies to solve problems in the practical operation link.

6.2.4. Resolving Doubts and Completing Projects

Combining the situation of students completing games and tasks, various digital resources are comprehensively applied to concretize abstract knowledge, and the syntax of the box model's border, internal and external margins, and background settings are taught, and the solution to the box model task in this project is demonstrated. Students work in small groups to share problems and possible solutions they have come up with. According to the teacher's explanation and demonstration, students complete part of the operation task by themselves, and upload it to the course platform. Students encounter problems in independent exploration, and find solutions to problems under the guidance of teachers, aiming to deepen students' understanding and application ability of box model knowledge.

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6.2.5. Varied Practice, Learning by Analogy

The teacher can launch an online voting activity on the online course platform to test students' understanding of the box model size and explain the calculation rules of the box model size. Next, students are further inspired to think: how to set the four borders differently? How to set the inside and outside margins of the four sides differently? Students can complete the voting based on their understanding and complete the cases of different-shaped borders and internal and external margins. Through the production of the "Hot Recommendation" column, students have learned the basic settings of the box model's related attributes, but they have not yet mastered the setting of the different attributes in the four directions. Special cases allow students to deepen their understanding of attribute settings and encourage them to explore how CSS properties can achieve these special effects, thereby promoting the deepening of understanding and the flexible application of knowledge.

6.2.6. Summary and Consolidation, Applying Knowledge

According to the students' classroom learning and the completion of the uploaded tasks, the teacher will make a concise classroom summary of the teaching content. Next, students are Inspired to think about how to use the knowledge learned in this lesson to improve their layout, such as from vertical arrangement to horizontal arrangement, and prepare for the next lesson to learn CSS floating. Students are encouraged to carry out personalized design according to their own aesthetic and design concepts, such as changing the border style or background color to highlight the column characteristics, so as to improve students' design ability and innovative thinking.

6.3. Post-class Extension Phase

In the post-class extension phase, students are required to use effective resources according to their personal situation, guided by interest or teacher's guidance, to choose a web page design project and apply the knowledge of the box model to page layout design. They are also encouraged to share their projects, problems encountered, and solutions in the class group or learning management system, so that students can receive valuable peer feedback and stimulate their motivation to improve and perfect their designs.

7. Conclusions

The "Internet+" blended teaching model oriented by competency and centered on students has successfully broken through the limitations of traditional education in terms of time and space by fragmenting teaching content and using digital resources and mobile learning platforms, providing students with more flexible and personalized learning paths. By closely integrating theory with practice and transforming abstract knowledge points into tangible and perceptible practical projects, students' interest in learning has been greatly stimulated, and their participation and practical ability have been improved. At the same time, teachers can also adjust teaching strategies and content in a timely manner according to students' learning progress and feedback. According to the statistical analysis of students' learning feedback and course grades, students have made significant improvements in professional skills and project practice ability in web front-end development. Through interactive functions of the online teaching platform and gamified learning strategies, the number and quality of student interactions in the classroom have been significantly improved, and classroom participation has been effectively enhanced, with post-class learning discussions becoming more active. The student satisfaction survey collected through questionnaires shows that most students are satisfied with this teaching model and believe it helps to improve their motivation and interest in learning.

Despite the certain effects achieved by the blended teaching model, some challenges have also been encountered in the implementation process, such as the differences in students' self-learning abilities and the possibility of students' points being technically increased, indicating that while technology brings convenience, it may also bring some side effects. To address these issues, teachers need to scientifically design and monitor learning activities to ensure the fairness and effectiveness of the assessment mechanism. At the same time, there are also problems with unequal division of labor within the group learning, where excellent students often have more opportunities to express themselves, and students with learning difficulties are prone to being alienated and becoming onlookers. While promoting cooperative learning, more teacher intervention measures are needed to ensure that every student can participate fairly and fully exert their potential.

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