

Empirical Research of “Java Programming” Practical Training Base on OBE Theory

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Abstract: This paper demonstrates the teaching effectiveness of Outcome Based Education (OBE) in “Java programming” practical training by designing a set of project-oriented teaching model applicable to Java object-oriented programming training course in higher vocational colleges. The teaching practice of “Java Programming” curriculum are widely used, and the remarkable teaching results have been obtained. It provides an example for the experimental research in higher vocational programming training course.

Keywords: Java programming; Practical training; OBE; Teaching effectiveness

I. Present teaching situation

The purpose of the Java programming training course in higher vocational colleges is to cultivate talents in Java software development to meet the requirements of enterprises, and is a frontier for exploring the reform and research of practical training courses. The OBE concept presents that teaching design and teaching implementation should take the final outcomes of students as the main goal, and is being widely spread because of its good results. However, there are few teaching researches that have been conducted on the implementation effect of OBE in practical training courses of computer programming. For this reason, it is an urgent motivation to examine the effectiveness of application of OBE to the practical training course of object-oriented programming in Java.

The Java object-oriented programming training is designed to meet the job requirements of Java programmers, and to achieve the professional goal of “high-quality software development and application talents”.

The teaching concept of this course is to take the work of Java programmers as an integrated enterprise process, and to split it into project tasks. The course uses project (task) as the carrier for students to master the skills and methods of Java application development. The course takes the project as the carrier, integrates and sequences teaching content, and designs relevant teaching context units. The completion of each unit task is consistent with the work flow of the enterprise, including the following five steps: software development (demand) analysis, (system) design, (code) writing, testing and operation.

II. OBE project-oriented teaching and traditional project-based teaching

In traditional project teaching mode, students have no practical project development experience and completely follow the teacher to independently carry out programming learning and code writing, resulting in poor teaching effect.

OBE project-oriented teaching, which originated from abroad, has gradually become one of the most widely used teaching modes after being introduced into China. This course has carried out several teaching practices during the epidemic period, turning challenges into opportunities through a hybrid teaching model of online and offline. Teachers can comprehensively score through regular tests, lab reports and code quality inspection, and finally convert the assessment results of students so as to have an accurate grasp of students' learning. In the teaching process, students with different abilities, genders, backgrounds and characteristics are assigned to the same group for pre-test. They learn in groups, and finally share their learning results with other members. Through the combination of grouping and various evaluation forms, students can fully engage in inter-group competition and intra-group cooperation, enhance communication with each other and improve learning initiative.

III. Experiment on course implementation effect

112 students from two classes majoring in our college were used as test subjects, including 55 students from mobile Class 1 (experimental class) and 57 students from mobile class 2 (control class). 20 students from Class I were selected as the experimental group and 20 students from Class II were screened in pairs as the control group; OBE project-oriented teaching was implemented in the experimental class; traditional project-based teaching was implemented in the control class. The experimental group was grouped by gender, and was divided into three groups depending on the high, medium and low scores of the pre-test. The control group used the traditional project-based teaching method.

A) Teaching research design: The experimental and control group, its pre-test and post-test design of this study are shown in Table 1 below:

Table 1: Design of Experimental and Control Groups and Pre- and Post-Test for This Study

Pre-test	Experimental group (OBE project-oriented teaching)	Post-test
Post-test	Control group (traditional project-based teaching)	Post-test

B) Pre and post-test methods:

Pre-test: To ensure the consistency of the pre-test scores, the experiment was conducted by screening paired sampling, the experimental

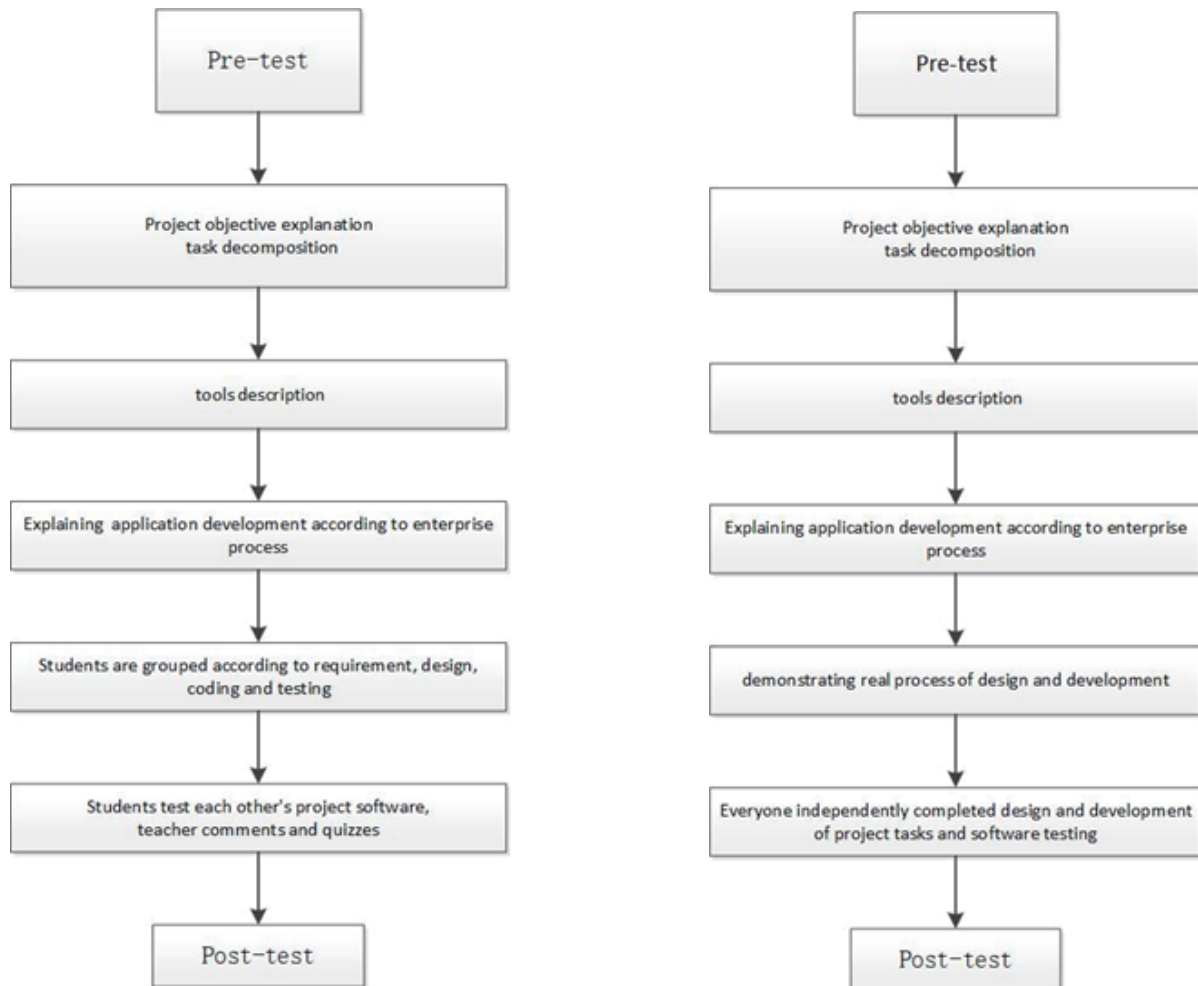
group was grouped by different gender and the control group was screened in pairs. Pre-test scores were weighted and averaged, and then another weighted average was taken from 50% of the average scores and 50% of the midterm test scores of the practical training course; the better score was selected from twice midterm test scores.

Post-test: The average score was weighted by 20% of basic knowledge, 20% of code completion, 20% of documentation completion, and 40% of practical training.

(C) Teaching design

The teaching designs of the experimental group and control group in this study were shown in Table 2 and Table 3 below:

Table 2: Teaching Design for the Experimental Group in This Study **Table 3: Teaching Design for the Control Group in This Study**



The experimental group and the control group in this study mainly differ in the fourth and fifth steps. The experimental group used interest group learning and the teacher plays a guiding and helping role in students' study. At the end of the project, groups of students test each other's software, find out bugs and correct them with each other, so as to improve the students participation. While the control group mainly learns by traditional project-based teaching.

(D) Data processing

The data collected in this study were processed using the statistical software SPSS for Windows 12.0.1, with the following main statistical methods adopted:

Independent sample t-test: to examine the differences between OBE project-oriented teaching and traditional project-based teaching in practical training of Java programming.

Paired sample t-test: to examine the teaching effectiveness of OBE project-oriented teaching and traditional project-based teaching in practical training of Java programming respectively.

The statistical significance level of this study is determined as $\alpha = 0.05$

(E) Results and discussion

1. Paired sample t-test for teaching effectiveness of OBE project-oriented teaching method in Java programming practical training

Table 4: Summary of t-Tests for OBE Project-Oriented Teaching in Java programming practical training

Group name	Pre-test scores Average(S.D.)	Post-test scores Average(S.D.)	t value	Correlation coefficient	p	Result
Experimental group	57.80(10.81)	74.84(7.96)	-13.886	0.828	<0.00001	Post-test > Pre-test

As can be seen from Table 4, the pre-test and post-test showed a <0.05 level of significance ($t=-13.886$, $p<0.00001$) between the pre-test and post-test, and the mean of the pre-test (57.80), which is significantly lower than the mean of the post-test (74.84), indicated that the pre-test and post-test of OBE project teaching in Java programming practical training reached significant ($p<0.05$), and showed that the teaching method in programming practical training has significant pedagogical effectiveness. The correlation coefficient value between the pre-test and post-test was 0.828 and showed a significance at the level of <0.00001, thus indicating a significant positive correlation between the pre-test and the post-test. The achievement and effectiveness was derived from the project implementation of team members.

2. Paired sample t-test for teaching effectiveness of traditional project-based teaching method in Java programming practical training

Table 5: Summary of t-Tests for Traditional Project-Based Teaching in Java programming practical training

Group name	Pre-test scores Average(S.D.)	Post-test scores Average(S.D.)	t value	Correlation coefficient	p	Result
Control group	54.11(13.27)	66.44(14.14)	-8.76	0.994	<0.00001	Post-test > Pre-test

As can be seen from Table 5, the pre-and post-tests of traditional project-based teaching in practical training of Java programming reached significant ($p<0.05$), indicating that traditional project teaching also has significant teaching effectiveness in programming practical training. This means that students can achieve significant learning outcomes in the practical training operation as long as they continue to practice.

3. Independent sample t-test of teaching effectiveness between OBE and traditional project-based teaching in Java programming practical training

Table 6: Summary of Independent Sample t-Test Analysis between OBE Project-Oriented Teaching and Traditional Project-based Teaching Methods in Java programming practical training

Scores	Experimental group Average(S.D.)	Control group Average(S.D.)	t value	p	Result
Pre-test	57.80(10.81)	54.11(13.27)	1.09	0.279	Experimental group = Control group
Post-test	74.84(7.96)	66.44(14.14)	2.66	0.011	Experimental group > Control group

As can be seen from Table 6, the experimental group and the control group did not show significant results in all pre-tests ($p>0.05$), and different samples showed consistency in all pre-tests without difference. The lack of significant differences in the scores in the pre-test also indicated that the heterogeneous matching and screening methods of the subjects were reasonable. As for the post-test scores, the experimental group showed significantly ($p<0.05$) higher scores than the control group in Java programming training, indicating that the effectiveness of OBE project-oriented teaching was significantly better than that of traditional teaching.

IV. Summary

It can be concluded that the OBE project-oriented teaching model proposed in this paper corrects many common problems in traditional teaching, improves students' participation consciousness and cooperation spirit, and greatly promotes students' learning enthusiasm. In addition, given the emphasis on division of labor and communication in enterprise process-oriented projects, the effect of project oriented teaching based on OBE in this study will be significantly better than that of traditional project teaching.

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