

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

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Abstract: This paper demonstrates the effectiveness of outcome based (OBE) teaching of practical training course in object-oriented programming in Java by designing a set of OBE project-oriented teaching model applicable to Java practical training of object-oriented programming in higher vocational colleges. The findings show that outcome based (OBE) teaching is effective in the practical training of object-oriented programming in Java and serves as an experimental research example for the higher vocational programming practical training course.

Keywords: Object-oriented in Java; Practical training of Java programming; OBE-based teaching; Teaching effectiveness

The practical training course of Java-oriented programming in higher vocational colleges is aimed at cultivating talents in Java software development to meet the requirements of enterprises, which is the frontier of exploring the reform and research of the practical training courses. However, even though the OBE concept, which presents the main goal of students final outcomes in instructional design and implementation, is widely applied for its effectiveness, little research has been conducted on the effectiveness of its curriculum implementation in computer programming practical training courses. For this reason, it is an urgent motivation to examine the effectiveness of application of outcome based education (OBE) to the practical training course of object-oriented programming in Java.

1. The practical training on object-oriented programming in Java 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 split the work of Java programmers into project tasks as a holistic enterprise process, and to use these projects (tasks) as the carrier for students to master the skills and methods of Java application development. This course is a project-based course that integrates and sequences teaching content with relevant teaching context units designed. Each unit task is completed in line with the enterprise workflow, i.e. the five steps of software development: (requirements) analysis, (system) design, (code) writing, testing, and operation.

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

The traditional project teaching mode, in which students have no practical project development experience, and follow the teacher to learn programming and coding independently, has poor teaching effect. However, OBE teaching, which originated from abroad, has gradually become one of the widely used teaching models after scholars in China introduced the strategy into the country. Accordingly, the teaching outcome of this course is mainly based on the concept of OBE which emphasizes the learning effectiveness orientation and maximizes the learning effectiveness to meet the knowledge reserve of subsequent Java framework technology and Android mobile development technology, and also to give consideration to the R&D technical ability and problem solving ability that students have after graduation. During the worldwide pandemic, the online and offline hybrid teaching mode was adopted to turn such challenges into opportunities. Teachers conducted several times of teaching practices through evaluating students learning on regular tests, lab reports and code quality checks to convert into their assessment scores. The teaching process was that students with different abilities, genders, backgrounds and traits were assigned to the same group for pre-testing, learning in groups, and finally sharing their learning results to other members; and students can fully engage in inter-group competition and intra-group cooperation through the combination of grouping and various forms of evaluation to enhance communication and improve their self-motivation in learning.

3. Experiment on course implementation effect

Two classes of 112 students majoring in mobile Internet in this college were used as subjects: 55 students in Mobile Internet Class I (experimental class) and 57 students in Mobile Internet Class II (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 assigned to the same group depending on the high, medium and low scores of the pre-test; the control group was taught by the traditional project-based teaching method.

A) Teaching research design: The design of experimental and control groups and pre- and post-test for this study was 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
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Post-test	Control group (traditional project-based teaching)	Post-test
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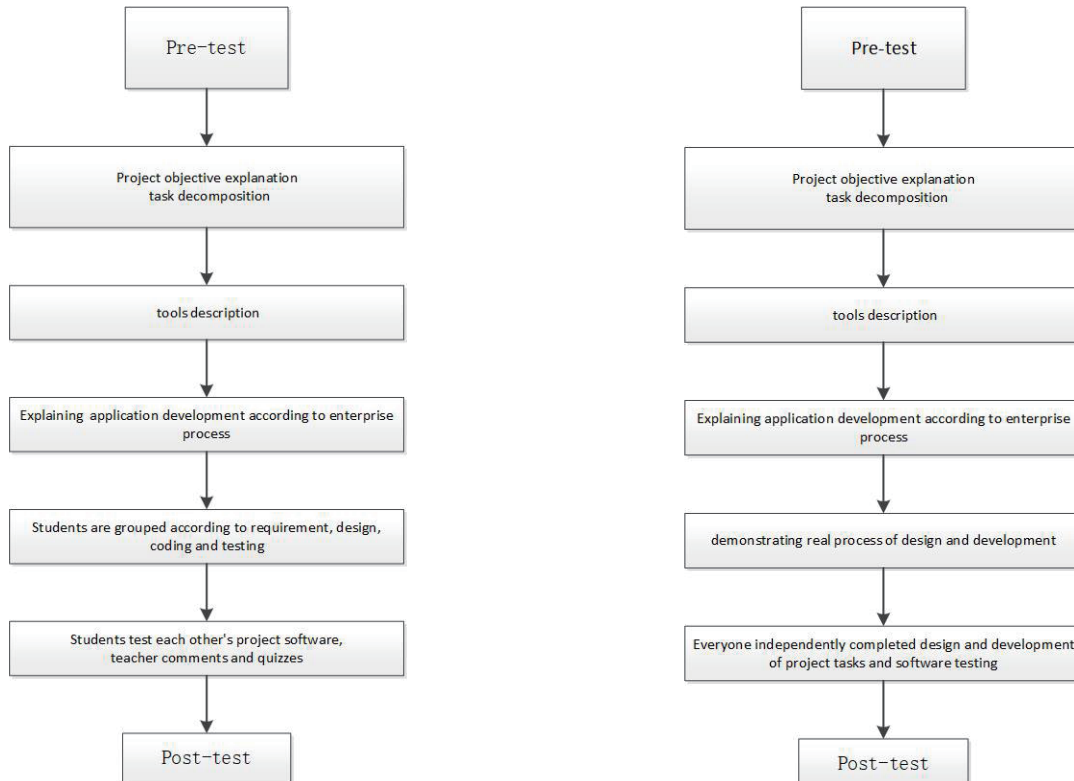
B) Pre and post-test methods:

Pre-test - To ensure the consistency of the pre-test scores, the experimental group was grouped by different gender and the control group was screened in pairs after screening paired sampling. 2 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 and midterm test scores of the practical training course; the better score was selected from the midterm and 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 for 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, where the experimental group learns in interest groups and the teacher plays a guiding and helping role in the students learning, and in the end the students complete the project so that each group of students can test their developed software with each other; and find out the 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 practical training of Java programming

Table 4: Summary of t-Tests for OBE Project-Oriented Teaching in Practical Training of Java Programming

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, and the achievement effectiveness was derived from the project realization of the team members.

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

Table 5: Summary of t-Tests for Traditional Project-Based Teaching in Practical Training of Java Programming

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 pedagogical effectiveness in practical training of programming. This means that students can achieve significant learning outcomes in the hands-on programming training as long as they practice repeatedly.

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

Table 6: Summary of Independent Sample t-Test Analysis between OBE Project-Oriented Teaching and Traditional Project-based Teaching Methods in Practical Training of Java Programming

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 and control groups did not show significance ($p>0.05$) for all of the pretest scores, and the different samples showed consistency and no differences for all of the pretests. The lack of significant differences in the scores in the pre-test also indicated that the way subjects were paired and screened by gender was reasonable; As for the scores in the post-test, the experimental group showed significantly ($p<0.05$) higher scores than the control group in the practical training of Java programming, which indicated that the effectiveness of OBE project-oriented teaching was significantly better than that of traditional project-based teaching.

4. Summary

It can be conclude that the OBE-based project-oriented teaching model proposed in this paper improved many common problems in traditional teaching, increased students sense of participation and cooperation, thus considerably boosting their learning motivation. In addition, given the emphasis on division of labor and communication in enterprise process-oriented projects, the effect of OBE-based project-oriented teaching in this study was clearly better than that of traditional project-based teaching.

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