Exploration of Examination Reform on Programming Foundations

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Abstract. The rapid developing computer technologies and its increasing popularity of computer applications bring forward higher and higher requirements on computer teaching for non-computer major of higher education institutions. Computer technical level and its application ability have become an important standard to evaluate the quality and level of college students. Therefore, the teaching reform on computer programming courses is imperative. Based on the actual teaching situation, in response to the lack of scientific and objective assessment standards for teaching process in current online and offline blended curriculum teaching, it is proposed to adopt a three-step teaching promotion method of pre class, in class, and post class, with each course holding a competition to promote teaching. This teaching plan has formed a comprehensive evaluation model reform plan consisting of five parts for the learning process. Namely: homework test evaluation, classroom performance evaluation, online experimental project evaluation, course competition evaluation, and written examination. Taking the "C++Programming" course of 2022 grade students as an example, this article provides a detailed introduction to the implementation details and practical application effects of the teaching evaluation plan.

Keywords: Programming foundations; Examination reform; Blended teaching; Evaluation mode

1. Introduction

21st century is a rapid development era in information technology. With extensive use of information technology in social life taking computer as the core, the computer knowledge and skill mastered by students is an indispensable component of the educational system of higher educational institution [1]. The course Programming Foundations is a compulsory Public Basic Course of non-computer major of higher educational institution. Aiming at freshmen of a college, from the exam-oriented education of a middle school to the independent learning of a college, in a great extent, an exam is a baton. A student may learn according to the exam given by the school. The reform on existing teaching contents, teaching methods and examination and evaluation methods is imperative to cultivate students to do constructive work with a computer.

In recent years, various universities have been continuously trying to improve teaching assessment and evaluation plans in practical teaching, strengthening the guidance of students to develop excellent practical skills through independent learning [2-3]. However, in practical teaching, there has been a lack of unified scientific standards for the grasp of process assessment, and the influence factors of subjective impressions and biases have not been fully considered, resulting in a lack of fairness and accuracy in the assessment process. On the other hand, the implementation of assessment standards is sometimes too strict, with excessive emphasis on quantitative indicators, while ignoring non quantitative factors such as quality and effectiveness, resulting in inaccurate evaluation results; it is difficult to reflect the true learning situation of students, which affects some students' enthusiasm for learning. We are committed to exploring a set of effective evaluation standards in the reform of the exam for the program design foundation courses. Utilize teaching application software to record the entire process of students' participation in learning. Propose a comprehensive assessment and evaluation of students' learning process from five different perspectives, making the procedural evaluation of the curriculum more equitably and transparent, greatly reducing the impact of personal bias and subjective factors.

2. Existing Problems and Its Solutions

Evaluation mode on traditional curriculum learning takes mastery of knowledge as the only evaluation standard. Therefore, in the long run, the examination on Programming Foundations relies on the results of final examination. Although constant efforts to try and explore how to objectively evaluate students during the learning are made, yet the effect is not obvious. In the past, the assessment of learning process focused too much on quantitative indicators such as attendance rate, number of homework completed, number of experimental reports submitted, and chapter test scores, while neglecting non quantitative indicators such as whether students' attitude during the learning process is serious and whether homework is true and effective. This kind of process assessment is difficult to monitor students' learning process in real-time, leading to a lack of objectivity and fairness in the evaluation results, and also unable to achieve the goal of motivating students to learn independently. Some students who do not work hard find students with good academic performance or friends to help write programs in order to complete programming assignments, or plagiarize programs already completed by other students; Some students search for answers online, regardless of whether they are right or wrong, and only hope to hand in enough homework to pass the exam. There are even some students who do not actively practice programming skills on the computer, hoping to memorize program modules or memorize previous year's exam questions before the exam to improve their exam scores. This makes some students neglect the real significance of learning and just for high score. The students cultivated in such traditional examination mode have poor manipulative ability. Considerable numbers of students are qualified even excellent according to their general achievements. But they do not know how to start when they write programs to solve practical problems [4].

Based on this, we have been making constant exploration and practice on evaluation system and examination reform in computer programming design course. We rely on the "Learning app" and "Experimental Teaching Platform" to arrange course construction, to strengthen the evaluation on blended teaching mode of online and offline teaching and it will give a general, objective and scientific overview from various aspects and angles [5-6].

3. Reform Plan on Examination Evaluation Mode

The examination on the course The Foundation of Computer Programming is given by the course teacher, the question type and the examination content had no unified requirements before, now it is changed that the unified examination proposition is given by experts. Although the examination content is unified, yet there are a lot of existed problems. For example, different majors have different requirements, and accordingly, the teaching emphases are different. Therefore, we will divide the "Fundamentals of Programming" course into three parallel courses: Programming in C Language of computer major, Programming in C Language of non-computer major in engineering department and Programming in C++. This makes it easier to carry out stratified teaching based on majors [7].

During the new course teaching of "Programming Foundations", we adopt Three-step Progress: before, in and after class, it adopts one course one competition, using the competition to promote the teaching. It brings forward the evaluation mode on the general examination on course learning composed of five parts of "Homework Evaluation + Classroom Assessment + Online Experimental Project Assessment + Competition + Written Examination". This makes it more reasonable to assess the teaching evaluation process from different perspectives. The teaching assessment and evaluation system is shown in Fig. 1.

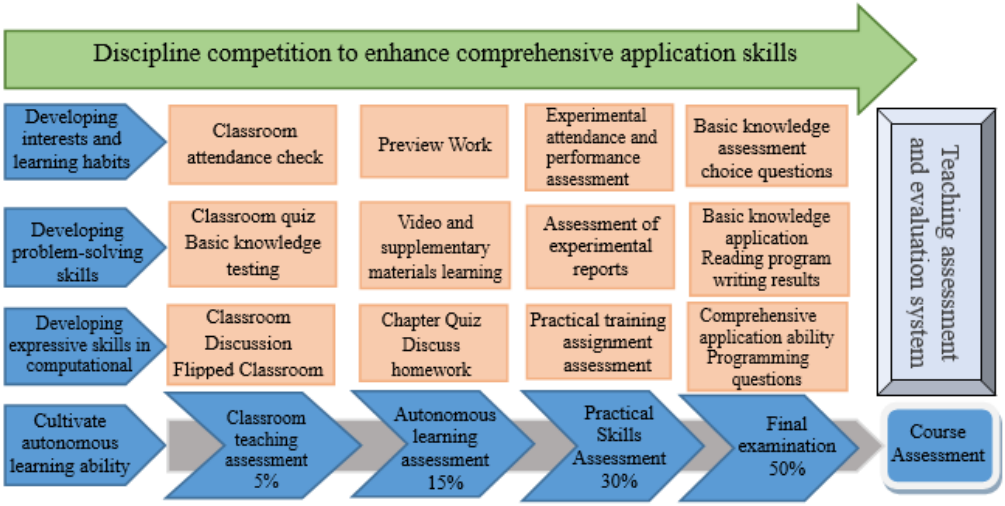

Figure 1. Teaching assessment and evaluation system

In Fig. 1, the assessment proportion for learning process has been strengthened in the course assessment. We divided the final evaluation score into: regular assessment (20%), experimental scores (30%), and final written examination (50%). Among them, the regular assessment includes classroom attendance rate, classroom interactive answering questions, post class discussion assignments, and post class chapter tests; Computer experiments include attendance rate in computer classes, classroom performance, experimental report assignments, experimental platform assignments, and competition participation; The content of the final written exam includes basic grammar knowledge assessment questions, such as multiple-choice and true/false questions and comprehensive programming skills application questions, such as reading programs, program code filling in the blank questions, and programming questions.

3.1 Usual Classroom Performance and Homework Assessment. In classroom teaching, collective lesson preparation and unified teaching plan are adopted and the course teachers are encouraged to create individualized courseware to strengthen teacher-student interaction and stimulate students' learning interest. When giving lessens offline, teachers may give classroom practice through "Learning app" to make students answer questions online, select students randomly to participate into flipped classroom activity, make more students to attend in the learning and exploration in the new knowledge to activate classroom atmosphere, relying on the statistical function of teaching software to record students' classroom atmosphere, making the assessment of each student have a basis.

During the online teaching, teachers may build lessons on the "Learning app" before class. After giving lessons, it shall release the content of lessons preparation, classroom video explanation, discussion homework, basic practice, chapter and section test, simulation test, and various types of classroom homework and reference materials, it may use the monitoring function supplied by the teaching software to understand the academic progress of students, to send warning information for unqualified students, guaranteeing learning quality of the students selecting such courses.

Taking the 2022 student C++ programming course as an example, after creating the course in the "Learning APP", a total of 22 learning chapters and 59 different types of learning tasks were released, including teaching courseware, teaching videos, chapter quizzes, discussion assignments, programming practice assignments, and review exams. The statistics of each type of task point and weight proportion are shown in Table 1. Among them, there are 38 learning process assessment projects and 21 auxiliary learning tasks to meet the needs of students with different foundations for course learning. After the class starts, teaching assistance software can effectively record the entire process of students' participation in learning, and calculate the points for completing various learning tasks.

Table 1. Detailed Table of the Number and Weight of Tasks in Each Chapter of the C++Programming Course in the Learning App

Statistical Items \ Learning Tasks		Audio and video		Test score		Homework		Comprehensive		
								Supporting materials		Chapters learning frequency
		Chapters	Review	Chapter Test	Review Test	Discuss	Program	Chapters	Experiment	
Quantity Value		16	3	11	3	1	3	13	8	≥22
Weight proportion	Itemize	35%	5%	20%	15%	5%	10%	0	0	10%
	Summary	40%		35%		15%		10%		

At the beginning of the semester, the teacher will create C++programming course on the "Learning App" and set the proportion of each weight according to the task point classification in Table 1. At the end of the semester, the software calculates the scores of students completing various task points during the learning process, generates classified and summarized scores, and uses them as the assessment basis for students' process learning performance. Fig. 2 is a percentile score curve for each weight item of class students generated by teaching assistance software.

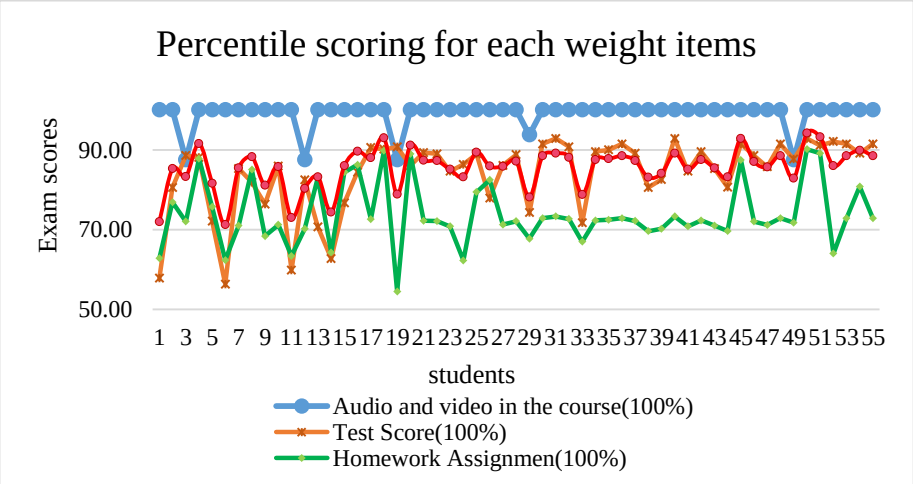

Figure 2. Score of each weight item for class students

As shown in Fig. 2, most students choose to watch teaching videos after class. Students who complete chapter testing and programming assignments well also have good overall scores. The significant difference in points is the completion curve of after-school programming homework, which reflects the mastery of comprehensive application skills by different students. The mutation points on the curve can clearly identify students with excellent academic performance and students who need to be warned if their grades are not up to standard. Further analyze the detailed score table of students' various learning tasks recorded in the teaching assistance software, identify knowledge points that "students in need of warning" do not have, help them improve their learning methods in a timely manner, and strive to complete their homework tasks.

3.2 Computer Operation Evaluation. Computer Programming is a course with strong practicality. Besides the theoretical study, it is equipped with the teaching material Guidance in Computer Operation. This course includes 32 class hours of theory and 16 class hours of computer operation. Therefore, the examination on the Computer Operating Experiment can’t be ignored.

During the implementation of experiment teaching, we rely on “Practice Teaching Platform” to arrange the online programming homework. The homework in practical training includes basic training and advanced training. It may help different students with their programming skills in their spare time, solving the practical problems with the mastery of computational thinking. When preparing the content of programming practice homework, ideology and politics may be integrated

properly. It is encouraged that students organize study groups volunteer to explore solutions. This learning style gives students more free space. It does not only build up the right sense of worth and consolidate the mastery of basic knowledge, but also increase students' learning interest in computer programming. It will provide adequate basis to examine students' computer civilization quality [8-9].

Accordingly, experiment grade accounting for 30% include: attendance rate (5%) + experimental report homework (15%) + homework of practical teaching platform (10%). In addition, the course competition results are recorded as reward points in the experimental assessment.

3.3 Written Test Results. Written test is an important part to assess a student's knowledge system and quality ability. Generally, an examination on basic knowledge mainly adopt written mode. In order to examine students' mastery of all knowledge and their comprehensive application ability, we have reformed test paper content and question type, for example, the examination type taking objective questions as main before is changed into the examination type taking subjective questions as main. Question type includes: the choice questions examining basic knowledge, fill-in-the-blanks questions giving result through reading programs and programming questions using comprehensive application skill. Such kind of question structure does not only examine the students' mastery of basic knowledge, but also assess students' ability to solve question with knowledge comprehensively.

4. Application Result

In the school year 2020-2023, we conducted a comprehensive reform gradually on the examination for "Programming Foundations", meanwhile, used above examination mode to assess reform plan. It is widely popularized among the freshmen, obtaining good comments and getting good result. The three consecutive years' school level Programming Competition have fully mobilized students' learning enthusiasm, the number of students for answering questions is increasing obviously and classroom atmosphere is becoming active, the number of students for active learning and active computer operation also is increasing obviously.

At the "2nd National Programming Competition in C for College Students" in June 2023, Xi'an Technological University organized 205 students to sign up undergraduate group competition. This competition received positive response from 456 colleges and universities about 10975 students. Finally, 16 students from our university obtained the first prize, 35 students, the second prize and 30 students, the third prize. Meanwhile, our university obtained the excellent organization award.

5. Conclusion

Teaching assessment and evaluation are indispensable and important links in the learning process of students. Establishing scientific evaluation standards to ensure the fairness and transparency of the assessment process can better motivate students to actively participate in learning and exploration, and cultivate innovative abilities [10]. Establishing a comprehensive feedback and early warning mechanism for assessment and evaluation results can ensure timely and accurate feedback on students' learning quality, so that teachers can provide assistance to students who have difficulty learning knowledge, make progress together, and enhance students' satisfaction with course learning.

The completion status examination of the task of Learning-app is a boot process and its purpose is to guide students' mastery on knowledge for theory curriculum further, laying a solid foundation in comprehensive application. Practical Teaching Platform Examination is a process strengthening practice. Its purpose is to improve students' manipulate power and let students use what their learned. Written examination is to examine students' mastery on basic knowledge and comprehensive application ability. Only combining the three aspects, it may play the role of the examination authentically, rationally evaluating students' learning process.

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