The Research and Practice of Process-based Assessment and Evaluation of Software Courses

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Abstract—**This paper analyzes the characteristics of software courses and the problems existing in the traditional assessment mode, and puts forward the basic idea of process-based assessment centered on ability assessment. In order to highlight the ability assessment, an online assessment system is used to construct a process-based assessment model of four stages, including in-class assessment, experimental assessment, comprehensive assessment and club assessment. Through the implementation of ability-centered process assessment, students' enthusiasm and initiative in practice are stimulated, students' comprehensive application ability and innovation ability are improved, and teachers are liberated from the heavy course assessment to focus on other aspects of research.**

Keywords—software course assessment; ability assessment; process assessment; innovation ability

I. INTRODUCTION

With the expansion of the scale of higher education, improving the level of education and teaching has become the core factor for colleges and universities to improve their competitiveness. Curriculum assessment and evaluation, as an evaluation tool for education and teaching, not only has the function of detecting, evaluating, and feedback teaching results. It also plays a leading role in stimulating and correcting curriculum teaching and personnel training, and is also an important way to achieve the goal of school personnel training [1]. The document of the Ministry of Education clearly proposed "reforming the examination methods and paying attention to the study process and the evaluation of students 'abilities." How to carry out the spirit of the Ministry of Education and scientifically construct the system of curriculum assessment and academic evaluation of college students is a major problem that needs to be solved before university teachers and administrators [2].

As a local application-oriented undergraduate college, Nanyang Institute of Technology has always been committed to exploring the reform of course assessment methods. As the largest College of Nanyang Institute of Technology, the Software Academy has always attached great importance to the evaluation reform of software courses. Software course appraisal is not only a means of examining learning achievements, but also directly guides students 'learning methods and learning motivation. Through the reform of software course appraisal, students are encouraged to develop

their own learning methods and pay attention to the improvement of practical and hands-on ability and innovation ability [3-4]. The software college has accumulated some experience in software curriculum evaluation reform, but there are still some problems that need further research and reform.

II. PROBLEMS IN TRADITIONAL EXAMINATION MODE OF SOFTWARE COURSE

Software course is the basic course and the professional direction course of software specialty. The main purpose is to cultivate students' practical and creative ability. Software courses are different from other traditional courses and have their own characteristics:(1) They focus on practice,(2) They are more flexible and open, and(3) They require students to be creative and comprehensive [2],[9].Therefore, the evaluation of software courses can't use the traditional evaluation methods. Although many colleges and universities have also made certain reforms in the evaluation of software courses, there are still certain problems, mainly manifested in two aspects: not paying attention to the evaluation of practical and creative ability, and the performance evaluation is not scientific enough.

A. Do Not Pay Attention to Practical and Innovation Ability Assessment

Influenced by the traditional "knowledge-based" concept, the vast majority of courses distinguish students' learning effects by their final examination results. There is a widespread phenomenon: "emphasis on knowledge but neglect ability; emphasis on memory but neglect innovation; emphasis on theory but neglect practice", and the content of assessment is mostly centered on "teaching materials, teachers, and classrooms". It attaches importance to knowledge assessment and ignores the evaluation of ability. Eventually, the cultivated students have high scores and low energy [5].

Although experimental courses are set up in software course teaching, due to the time-consuming and laborious monitoring and experimental testing, most teachers only counsel in the experimental process, and gave the experimental grade according or the experimental reports submitted by the students during the class. Most of the students do not do the experiment class seriously, but they can get high scores by copying other students' experimental reports after class. Finally, it leads students to cope with the psychological existence of the experiment and do not attach importance to hands-on practice,

which affects the cultivation of students' innovation ability and practical ability [6].

B. Performance Evaluation is not Scientific Enough

The traditional software curriculum assessment model replaces comprehensive evaluation with examination results, replaces evaluation results with examination results, has too strong purpose, and students assault before exams, rote memorizing, and does not really understand and master the basic methods and techniques of software programming. So, it is not possible to apply the knowledge learned to solve practical problems. This situation limits students 'creative thinking ability and space, and is contrary to the goal of cultivating software talents with strong practical ability and innovative ability [2],[6].

III. THE IDEA OF SOFTWARE CURRICULUM EVALUATION REFORM

Due to the disadvantages of the traditional software curriculum assessment model, in order to further deepen the reform of education and teaching, guide and cultivate application-oriented and innovative software talents with strong practical ability and innovative spirit, software college combined with OBE concept and CDIO engineering ideas [7]. Taking the idea of "examination ability and emphasis on process" as the guide, we put forward a procedure-oriented assessment system centered on ability assessment, and replaced the traditional evaluation model of a final examination. We shift the focus of the assessment from the current knowledge to the improvement of quality and innovation capabilities, increase the weight of the process assessment and ability assessment in the overall assessment results, and strengthen the management of the student learning process. Pay attention to the cultivation of students' innovative ability, so that the assessment is really a means of learning rather than a goal [5].

A. The Course Assessment Method with Ability Assessment as the Center

Taking into full account the shortcomings of the existing assessment methods and combining the characteristics of software courses, this paper carried out the process-oriented and terminative assessment methods centered on the ability assessment, so as to realize the change of assessment content to focus on the comprehensive ability assessment and the change of achievement assessment to the comprehensive assessment. According to the characteristics of the course, various forms and stages of assessment are carried out to improve the proportion of students' comprehensive ability.

B. Construction of Process Assessment Model Based on "Internet +" Online Evaluation System

In 2017, the State Council issued the 13th Five-Year Plan for the Development of National Education, in which the "Internet + Education" strategy was included in the plan. In order to make full use of the Internet and its own advantages, Software school has developed an online evaluation system based on the concept of "Internet + Education". This system currently only is applied to "Object-oriented Programming"

courses and implements a process-oriented assessment model centered on ability assessment [3],[8-9].Through the online evaluation system, students' practical abilities can be evaluated at various stages such as in-class evaluation, experimental evaluation, comprehensive evaluation, and club evaluation. Students' ability assessment is placed at different stages and quantified by software. The system not only improves the classroom teaching effect of teachers, makes the course process assessment simple and easy, but also allows students to pay more attention to practical ability, encourage students to actively learn, standardize learning behavior, and improve the effectiveness of learning. It promotes the cultivation of students' comprehensive ability.

C. Process Assessment and Final Examination Combined

In addition to students' ability assessment by the online assessment system, the course final assessment uses "online examination system", each student's test papers are randomly generated according to the generation strategy [9]. After completing most of the topics are automatically approved, some of the topics need to be reviewed and corrected by teachers, and eventually the final examination results are generated. The final evaluation of the course consists of five parts: 10 % evaluation with in-class, 30 % evaluation of the experiment, 15 % assessment of the comprehensive project, 5 % assessment of the club, and 40 % of the final evaluation.

IV. IMPLEMENTATION PLAN OF PROCESS ASSESSMENT WITH COMPETENCY ASSESSMENT AS THE CENTER

In the fall of 2018, the School of Software used a combination of competency-based process assessment and final examination to evaluate students in the "Object-oriented Programming" course assessment. And explore the appropriate teaching content, teaching methods and evaluation system. Through the online evaluation system, the process assessment is divided into four categories.

A. In-class Assessment

Classroom is the main occasion of direct contact between students and teachers. The performance of students in the classroom can assess the level of student participation in the classroom. In the past, the assessment of classroom performance was mainly assessed by assessing students 'attendance, actively answering questions in class, and asking questions. However, implementation is more difficult, teachers' records and statistics are inconvenient, and it is unfair to most students. Because the students who are really willing to answer questions and ask questions are still a few students, and attendance is more of a formality. In the past, in-class performance assessment did not play a proper role [2].

Through the online evaluation system to evaluate the knowledge points as in-class performance assessment, students can focus on the important knowledge points, through hands-on practice to master these knowledge, improve students' practical ability. From another point of view, it also played a role in urging students to listen to the class seriously, and at the same time increased the student's achievement and learning confidence in hands-on practice.

The online evaluation system conducts the evaluation of knowledge points in the classroom. The specific process is: according to the curriculum, teachers set up test topics in the classroom in advance in the evaluation system. These topics only focus on a certain knowledge point, which is relatively simple. In order to save time from entering a large amount of code time, Teachers can preset the main body of the program in advance, leaving only the corresponding parts of the knowledge points to the students to fill in. After the students complete, the program is compiled and run, and the evaluation results are preserved. The specific interface is shown in Fig. 1 below. Through this form, students can practice while talking, so that students can master important knowledge points in the classroom. In order to attract students' attention to the in-class test, this part accounts for 10 % of the final score, and only records the results submitted during the in-class test period. In addition, only when the student passes all in-class test of corresponding stage, he can conduct the examination of the experiment in the next stage.
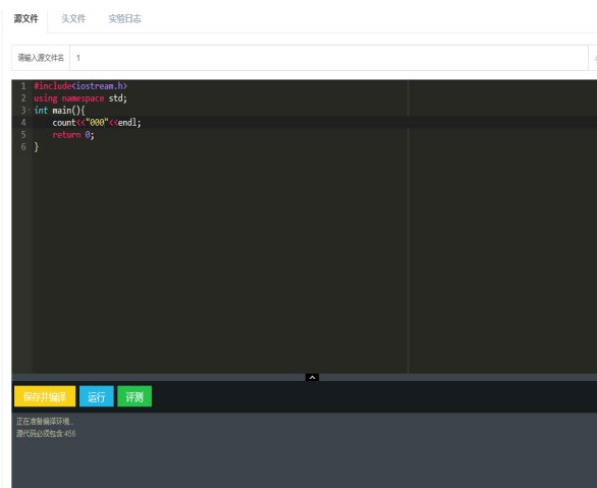

Fig. 1. Inspection interface

B. Experimental Assessment

In the previous experimental evaluation of software courses, the teacher arranged the experimental content in advance. The students completed the experiment in a fixed time room and then submitted an experimental report. After the class, the teacher gave the experimental results by correcting the experimental report. This form of organization has led many students to pay no attention to curriculum experiments. As a result, many students do not pay much attention to the course experiment, and deal with it casually in the experimental class. After class, copying other people's experiment reports and submitting them to the system, so the teachers do not seriously correct the experiment reports, which leads to the failure of the experimental assessment to reach the due purpose [3].

Through the online evaluation system, the experimental assessment process is as follows: The teacher sets the experimental topics in advance according to the experimental outlines. The students who have passed all the tests in the in-class assessment can complete the corresponding stage of the experiment. After completion, the system automatically recognizes and records each experimental result. In addition, Students also need to submit experimental reports through the system to analyze and summarize the experiments. This part of the achievement consists of two parts: classroom experimental results and experimental report results, accounting for 30 % of the final results.

C. Comprehensive Project Assessment

In order to evaluate students' comprehensive application ability and innovation ability, a comprehensive project evaluation has been added to the course assessment. After half of the course is conducted, teachers set up comprehensive projects through an online evaluation system to allow students to prepare and design in advance. Through the comprehensive project, students 'comprehensive application ability, innovation ability and ability to solve practical problems are tested. The comprehensive project is submitted after the end of the course, and the results can be automatically recorded through the system compilation. Comprehensive project assessment accounts for 15 % of the final results, mainly assessing students' comprehensive application ability and innovation ability.

D. Club Assessment

The School of Software has established more than 20 learning societies. Each club has applied for a laboratory as an open laboratory. The college encourages students to participate in an open laboratory which club manages. Each club regularly conducts training and evaluation for students. The club can use online evaluation systems to set evaluation topics. Students are allowed to study the content of the course in advance and improve their hands-on ability. This part is used as a club assessment results, accounting for 5 % of the final results.

V. CONCLUSION

Through the use of competency-based process assessment system in the evaluation of "Object-oriented Programming" course, the teaching effect has begun to show results. Using the online evaluation and tracking of the process assessment system, students have effectively stimulated the enthusiasm and initiative of learning. Students are fully aware of the importance of hands-on practice and have developed good habits of hands-on practice in the classroom and under class. Through the comprehensive project appraisal, the students 'comprehensive application ability and innovation ability were improved. Through the online evaluation system of process, it is easier and easier to make the process assessment, liberate the teacher from the heavy course assessment, and focus on the research of teaching methods and the setting of evaluation content.

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