Quantitative Assessment Indicator System Research of Engineer Practice in Computer Science

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Abstract. In university education of engineering, there are some problems in subjects of the software developing, such as Engineering Practice. To solve the problems, a quantitative assessment indicator system was introduced to the lecture. Using the system, the teaching process is divided into five stages, i.e. title selection, project analysis, design, implementation and testing, and defense. In every stage, different reports or code is demanded, and according assessment can be done quantitatively. Being taken throughout the lecture, the assessment result is more effective and fairer.

Introduction

Globalization posed new challenges to higher education. In Europe higher education, for example German and France, engineer practice has been emphasized traditionally. In America, the practice-centered integrative model was proposed instead of the analytic model which was around science. All these indicate that the higher education is in a practical trend returning to engineer and market.

Domestically, the student cultivation model in higher education paid more attention on theory, technology, and personal academic ability, rather then practice or creativity training[1]. Students do not come up to the social requirement. Therefore, the engineer education model of CDIO and the Excellent Engineer Cultivation Plan(EECP) were proposed by the National Department of Education. Several universities were chosen as test – beds. As one of the first EECP pilot major, the Computer Science of Chengdu University of Information Technology adopted the teaching model of CDIO early at home.

By teaching experience, continuous exploration and innovation for several years, an education model was concluded. In this model, the theory of CDIO is used in the excellent engineer cultivation. Reflected in the curriculum, a series courses of Engineering Practice have been offered in every cultivation specialty. Through the new teaching pattern, that is, study in practice and teaching based on projects, the engineer knowledge, engineer ability, team cooperation and engineer systematic ability are mainly trained. Students with these abilities can meet the society more creatively [3].

In advance, relative questions of Engineer Practice, such as the teaching objective, syllabus, content, teaching form and method, were researched. Serial results were achieved. But the lecture assessment is still deficient as following.

(i) without the lecture process assessment. To make students have excellent engineer skills, the lecture must be carried out according to the standard engineer process. So far the Engineer Practice has been taken with students as the subject and teachers as assistance roles. Although it is phased, the process tasks, aims, results and assessments are not definite.

(ii) The assessment system is incomplete. The assessment focuses on students' final project. The assessment indicators are not rational or quantitative.

With specialty and course attributes, the lecture process is divided under the guidance of CDIO. Tasks, aims and results in every stage are defined. The quantitative assessment indicator system, covering the Engineering Practice teaching, was designed in Computer Science. The method of using the indicator system was given and the potential issues were also debated. It should be noted that the Engineer Practice in this paper meant all software developing courses.

Course Stage Partition

According the software lifecycle theory, the Engineer Practice lecture is divided into five stages of the title selection, project analysis, design, implementation and testing, and the defense. Teachers can set time nodes with the course plan. Tasks in every stage can be described as follows.

In the title selection stage, 2 to 4 students are teamed up by themselves mainly. Few students would be adjusted to groups by teachers. In every team, a student is the leader. It is not suggested that one student act alone. Different team can choose suitable project. Project tittles are from actual enterprise applications and confirmed by teachers. Titles can be offered by students but must be permitted by teachers. Tasks in this stages should be completed mainly by students under the assistances of the class and team leaders with in 3 to 4 days. The results are that students group into teams and decide their team's project title.

In the project analysis stage, every team should complete the project analysis, including the feasibility and requirement analyses. Teachers should lay out the analysis method and possible problems of the feasibility and requirement actions with a real project as example, explain the analysis representation drawing with special tools, such as the use case diagrams using Viso. Then every team should analyze their project in different ways and write the feasibility and requirement analysis reports with templates from teachers. This stage would take two week.

In the project design stage, students should carry out the project design, including the general design, development schema, interface design and data structure design and so on. Teachers would interpret the design method, thought and tools with the real project, especially the drawing of the IOP figures, E-R figures and structure diagrams. Students would write the summary design manual as the periodical result. This stage would also take two week.

In the implementation and testing stage, every team should implement and test their project. Teachers should display the coding standard, testing schema and testing method to students, collect and explain the encoding problems from all teams. Students would also write detail design manuals and testing reports after the project implementation and testing. This stage would need 6 to 8 weeks.

The defense is the final examination of the course. In this stage, every team should write the final project report as this stage result and take part in the course defense. 2 to 4 teachers would execute the defense as the committee. Every student could take 10 to 15 minutes to introduce his or her work, present the according project functions and modify the code. Then teachers could decide the defense score with all the student defense effects in considered. This stage should take 1 to 2 days.

Assessment Indicator System Building

For the course stage aims, the assessment indicator system was built referring to the research achievements of the practice lectures[4-6]. The system was aimed mostly results in detail from every stage, which are displayed in Table 1. In the practice process, different result weight could be adjusted with course features. Besides, the score computed by quantitative indicators is the team score, and then every student score could be given according to his or her work.

Table 1 Assessment Indicator System

Stage	Assessment object	Assessment indicator	Score	Weight
Title selection	The project title	Accordance degree of the title and the course aim	20	0.05
		Project workload	35	
		Project difficulty	30	
		Matching of the project workload and the student number	1	
Project analysis	The feasibility report	Report format	5	0.1
		Report content arrangement	5	
		Premised description of the feasibility research	20	
		Feasibility analysis and evaluation of the	35	

Table 1. cont.

		project business and technology		
		Analysis and estimation of cost model	20	
		Analysis reasonability of project risks and aversion methods	15	
	The requirement analysis report	Report format	5	0.1
		Report content arrangement	5	
		Business analysis	25	
		Data discription	25	
		Functional requirement	25	
		Non-functional requriement	10	
		User interface requirement	5	
Project design	The summary design manual	Manual format	5	0.1
		Manual content arrangement	5	
		General design	15	
		Design introduction of function modules	30	
		Interface disign	15	
		Database design	30	
Implementation and testing	the system source code	Whether following the encoding conventions	30	0.05
		The necessary code annotation	40	
		Rational blanks among code lines	30	
	The detail design manual	Manual format	5	0.1
		Manual content arrangement	5	
		System structure	10	
		Description of modules and function	10	
		Interfaces	10	
		Flows	30	
		Class diagrams	30	
	The system testing report	Report format	5	0.05
		Report content arrangement	5	
		Testing schema	20	
		Testing cases	60	
		Analysis of the testing result	10	
Defense	The work introduction	Title, Development aim, Technological rout, Core technologies, General plan, Personnel arrangement, verbal dexterity, Ppt structure, Introduction clarity	10	0.3
	The project presentation	System function, Performance, User interface	30	
	The code modification	To modify some codes according teachers's demand	50	
	Cooperation	Team member roles, Student's performance	10	
	The project final report	Report format	5	0.15
		Report content arrangement	5	
		Background, aim, significance, the current research status	10	
		System analysis	20	
		System design	20	
		Implementation	20	
		Testing	10	
		Summary	10	

Conclusion

The assessment indicator system of the Engineer Practice changes the examination model, with emphases on the whole process instead of the final result. The system makes the course assessment fairer. The teaching experience proved that the system used the theory of Study in Practice effectively, strengthened the student engineer knowledge, improved the student abilities of practice and solving complex engineer problems, trained the student cooperation spirit, provided available explorations for the excellent engineer cultivation. Obviously, the assessment indicator system is in test and needs further researches.

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