

Active and experiential learning by Simulated Review of Design Scheme

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ABSTRACT

A practice of “Simulated Review of Design Scheme” in “Architectural Design and Construction” Course for Civil Engineering program in Shantou University is reported. The situational learning model in team design process described in this paper is based on the active and experiential learning methods according to CDIO standard 8. The paper focuses on introducing the use of a simulated review process, where the students were asked to take on different roles like designer, property developer, urban manager and the public. Also a discussion on the teacher’s guide work and the learning outcomes are included as well as some improvement suggestions to active and experiential learning for the course.

KEYWORDS

CDIO Standards; Active and experiential learning; Simulated Review of Scheme; Team Design Process;

1. INTRODUCTION

Quick urbanization development progress of China features in large-scale constructions of physical forms. An urgent task makes civil engineering education have to seek more efficient methods for students to learn to meet practical needs. Foundation courses mostly take specific designs of civil engineering pattern as objects and lay emphasis on direct teaching of knowledge and methods, which makes it easier to neglect active experimental learning through inspiration and environment utilization so as to improve students’ thinking and ability. Therefore a tendency of cultivating students to be “tool man” is resulted, which deviates from the direction of holistic education of higher education [1]. As one of the major professional foundation courses, “architectural design and construction” is just facing the difficult problem as well.

Since 2006, Engineering College of Shantou University has performed a CDIO reform [2]. Corresponding reforms were carried out for this course that the former theoretical instruction + course design mode was changed into the new mode of driving knowledge learning and ability cultivation through the whole process of a team design [3]. The team design project took “housing” as its design object, which is the most fundamental and largest architectural pattern with largest creative space. Five specific design themes (as shown in table 1) were provided for student teams to choose at will. 3 to 4 students were grouped one team to cooperate in a design of architectural scheme. To be in consistent with logics of practical housing design and construction, the reform added the segments of design display, evaluation and improvement which were much different from the prior way.

However, in the first few years of teaching practice, it was difficult for students to complete the evaluation and improvement segments just depending on their limited understanding to design. According to practical engineering, evaluation to design scheme must be carried out under a specific social environment, targeting detailed design contexts and allowing for participation by a particular group, while the improvement suggestion needs more critical thinking as its basis. Therefore, students can only complete the segments of design evaluation and improvements well along with the certain situation and the training of critical thinking. Given that students’ critical thinking can only be trained in the process of thinking, one effective solution is to adopt situational approach. Regarding architectural design and construction course, scheme evaluation in team design needs urgently critical thinking, namely making use of appropriate evaluation standard to determine the true value of architectural design and to clearly give judgment with complete basis. Only on such basis the improvements to design can be carried out. Therefore, in combination with features of design process and critical thinking, a specific situation that “simulative scheme review” activity as a carrier to train students’ critical thinking has been choose.

So Civil Engineering Department of Shantou University has developed simulative scheme review by situational approach in architectural design and construction course since 2011, with the aim of helping the completion of design segment and meanwhile training critical thinking of students.

2. Practice process

2.1 Creating Situation

The significance of this simulative scheme review is that training of students’ critical thinking, improving judgment of complex paradox of value and correcting design problem on the basis of thinking of multiplex benefit demands. Situation simulation can help students know about “the value of design” better, and get more detailed and true understanding to rationality of technique application involved in architectural design. Role play can help students understand multi-benefits and know about multiplex benefit demands so as to stimulate the cultivation of creative thinking.

In the whole process of simulative scheme review, teacher is the “learning guide” of students who is responsible for prophase organization and guide of class discussion in order to ensure students carry out deep discussion independently and mutual study in this process. Organization at early stage is to create situation, of which the core work is the role arrangement and determination of evaluation standards. It is not hard to arrange roles, coming up with four roles, “designer”, “property developer”, “urban manager” and “the public” for the meeting just depending on practical engineering logic.

Determination of evaluation standard is the key to training of critical thinking. Creators (teachers) mainly consider the following three principles:

1) Standard shall be determined according to roles. Different roles are different in design demands and value judgment. Only the course provides evaluation standards in accordance with role features to students playing roles, can help students deepen the understanding to value of design.

2) The standards shall correspond to skills of critical thinking. Core skills of critical thinking include interpretation, analysis, evaluation, inference, explanation and self-regulation [4]. The process when students carry out evaluation according to evaluation standards is the process of integrating and applying various skills of critical thinking. Evaluation standards shall be set corresponding to such 6 skills above mentioned.

3) Description of evaluation standards shall conform to the degree of knowledge that students grasped and design requirements in order to meet learning demands. Based on the comprehensive consideration of the above 3 factors, evaluation standards for the teaching design program are shown as follows in Table 1, 2 and 3.

Table 1
Evaluation form of “Property Developer” role

Evaluator information							
Role assignment	Property developer	Name		Team			
Evaluation information							
Design team No. (Design theme)	Item evaluation (score)					Total score	Main deficiency and improvement recommendations
	Meet content and depth requirements put forward by specifications (20')	Reasonable function and proper utilization of technique (20')	Distinct and outstanding design theme (20')	Design scheme is innovative and unique (20')	I am moved by designer's work and I am willing to invest for development (20')		
No.1 Adaptive housing							
No.2 economic housing							
No.3 Multiple generation coexistence housing							
No.4 Multiple class coexistence housing							
No.5 Green housing							
.....							

Table 2
Evaluation Table of “The Public” Role

Evaluator information							
Role assignment	The public	Name			Team		
Evaluation information							
Design team No. (Design theme)	Item evaluation (score)					Total score	Main deficiency and improvement recommendations
	Distinctive design theme(20’)	Design scheme conforms to the theme(20’)	Rational and practical function (20’)	Design scheme is novel and special (20’)	I like such housing and I’d like to live there (20’)		
No.1 Adaptive housing							
.....							

Table 3
Evaluation Table of “Urban Manager” Role

Evaluator information							
Role assignment	Urban manager	Name			Team		
Evaluation information							
Design team No. (Design theme)	Item evaluation (score)					Total score	Main deficiency and improvement recommendations
	Meeting the requirements for content and depth in specifications(20’)	Rational function and proper utilization of technique (20’)	Design theme is distinctive, positive and creative (20’)	Design conforms to the requirements of city planning (20’)	Design conforms to local residential custom and culture (20’)		
No.1 Adaptive housing							
.....							

2.2 Performance in Class

2.2.1 Preparation

Preparation shall be done by both teacher and students. Students shall finish their design scheme and make their presentations. In addition, they shall understand the meaning of scheme review and role features through their self-learning. Besides preparing for teaching design, teacher shall also allocate roles to students and explain the procedures of review meeting.

2.2.2 Allocation of Roles

Roles for review consist of “designer”, “property developer”, “urban manager” and “the public”. Members of each team not only play the role of designer in the evaluation of their own design scheme, but also play roles of “property developer”, “urban manager” and “the public” in the evaluation of other schemes. Evaluation of each scheme is composed of scores from different roles and amendment suggestion is formed through debate as the reference for team design.

2.2.3 Class Practice

Simulative scheme review is carried out in class. When review meeting is started, host (teacher) will introduce participants and meeting procedure first; then the every team’s design scheme will be reviewed in sequence.

The process of review includes:

- 1) Designers display in detail;
- 2) Question and debate time that students can communicate to each other about the content of expression of design theme, space layout and organization, technical and economic index, equipment configuration and using effect according to their learned knowledge under different roles;
- 3) Evaluation and score time that each team shall summary to get total score after different roles in team complete their evaluations. There are 13 teams of the class, each of which will receive evaluations from other 12 teams.
- 4) Meeting summary time that teacher will collect suggestions from each team and consent finally achieved and announce the result of review meeting.

3. Observations

During the whole process of the practising, teacher kept observing the students’ performance (as shown in Figure 1, 2), then in combination with the evaluation tables finished by students, teacher could gain more information on the learning outcomes.

3.1 Change of thinking

Before the reform, students seldom evaluate their own design scheme and had no will to elevate it. Compared with the passive attitude of students toward the design scheme before, the facts of enthusiastic question and heatedly debate of students in the simulative review as well as discussion with teacher for scheme improvement afterward have proved that students’ thinking has been open and they are ready to use such a “edge tool”, critical thinking, to finish the task of design improvement. Just as shown in students’ summaries: “In review of achievement display, I have learned how to look upon works of my own and others from two different angles: designer and property developer. In the process of scoring question, I try my best to think and learn how to investigate questions more meticulously and deeply.”



Figure 1. Designers display their scheme in Class Practice



Figure 2. The student's Simulation in Class Practice

3.2 Improvement of Design Work

Meanwhile, students indeed got new acknowledgement to their team design work through review and further improved their design scheme. For example, the design theme of one group was economic housing, in the simulated review student reviewers proposed every questions closely around technical and economic index and really found that it didn't highlight its "economic" theme according to index including plot ratio and per capita construction area which can show economy. Although the score for the scheme was not high, the designers of

the scheme were “sincerely convinced” and expressed their willingness to accept the suggestions and to make the improvements. Generally speaking, most students trained their critical thinking and really understood the value of architectural design through the simulative review. Just as some students’ summaries: “As a property developer, my evaluation is stricter than the requirements to myself in design! Although my design is not good enough at present, I finally know what architectural design is good. I can get it in the future!”

4. Discussion

During the whole process of scheme review, it not only requires the simulated evaluators to give a score but also needs them to propose some suggestions for improvements. Such arrangement was aimed at the self-regulation in critical thinking so as to develop constructive critical thinking. Critical thinking is rigid but also constructive. However, from the actual situation of evaluation perfumed by students, about 60% students can point out detailed deficiencies and give improvement suggestion while about 30% students are able to point out deficiencies but give no suggestion. The rest students left nearly blank of the work. From this point we can find that there are certain differences in degree when students use critical thinking.

In addition, having been guided by teacher to learn about senses of value about different roles in preparation stage, students may have doubt without full analysis of fact when playing other roles subject to their cognitive level and experience. For example, due to the influence of certain stereotype---such as property developer just pursuing economic benefits, the students to simulated developers tended to hold negative attitude when facing designs seemingly with higher cost. Actually, it shows that rigidity and rationality are not enough in critical thinking which needs teacher to point out and correct in time but also requires students’ quality improvements in social culture.

5. Conclusion

The simulated review of design scheme in Architectural Design and Construction Course can help students complete the evaluation and improvement process in a design more efficiently and meanwhile train students’ critical thinking. The main outcomes of this reform conformer to the CDIO Syllabus. We will constantly accumulate experience and try to get more improvements hereafter.

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