

# A Study on the Designing of Paradigm Teaching and Evaluating Index for Universities and Colleges

## Based on Teaching Design of Basic Mathematics Course

Xiaoqian Ban

School of Mathematics and Statistics  
Guizhou University of Finance and Economics  
Guiyang, China 550025

**Abstract**—According to the classical theory of teaching process, this paper discusses important links of teaching reform in universities, namely the design strategies of teaching process. The teaching of basic mathematics course is taken as an example to propose teaching design before, in and after class, in order to construct effective paradigm teaching model. Meanwhile, evaluation index of paradigm teaching effects is designed to improve and popularize paradigm teaching.

**Keywords**—universities; teaching reform; basic course; paradigm teaching

### I. INTRODUCTION

Universities shoulder different social responsibilities. In order to cultivate undergraduates to take postgraduate entrance exams or provide talents for the society, the priority among priorities of universities is to train students' learning ability, innovation ability and cooperation ability, which are the vitality of students' further development. Teachers carry out teaching reform around the subject. Teaching characteristics of different courses are greatly different. For disciplines with strong practicality such as accounting and marketing, teachers guide and let students independently learn basic theories through discussion, and then group students to design projects and evaluate and let students learn teaching contents through reflection. However, for theoretical and basic courses like basic mathematics, if the above learning style is adopted, students have to spend more time in self-study. Besides, the learning efficiency is influenced because problems found in self-study cannot be solved timely. Teachers of basic mathematics still use "three centers" namely "textbook-centered, teacher-centered and classroom-centered" teaching process of Herbart. [1] Teachers play leading role in teaching, base on textbooks and impart knowledge to students through teaching. It makes the teaching process normative and controllable and efficiently and rapidly improves teaching quality. However, with social and economic development, defects of the teaching process gradually appear. It neglects students' subjectivity and ability as well as the important role of feedback in teaching. At the

meantime, it is divorced from reality, depresses students' enthusiasm and goes against teaching improvement. Therefore, it is extremely urgent to improve paradigm teaching.

The theory of "Discovery Method" teaching process proposed by Bruner [2] provides important enlightenment on how to arouse students' enthusiasm of learning and how to design the teaching process that conforms to characteristics of discipline. "When proposing basic knowledge structure, reserve exciting parts and guide students to discover it." Different from the "Modern Education" idea of Dewey [3], he advocates equal attentions should be paid to discovery and representation, "find proper balance between the two". It is the theoretical basis of paradigm teaching in this paper. Selection of teaching methods and design of teaching process also follow this principle.

Flipped classroom of Aaron Sams is widely adopted in teaching reform at abroad. [4] Stimulate students to participate in learning after class, focus on discussion and solving more profound problems in class to improve classroom learning efficiency. In recent years, literature [5] shows teachers in some universities at home have paid attention to and practiced flipped classroom. However, most researches [6]-[8] on paradigm teaching in universities still center on theories. Compared with traditional teaching model, it has updated teaching idea. The teaching design respects students' nature and better arouses their enthusiasm in learning and lets them participate in class. For example, the "five-in-one" theory of scientific teaching paradigm proposed by Ma Lihui [9], "heuristic teaching paradigm" and "interactive teaching paradigm" conform to talent training objectives of higher education and center on training students' innovation ability and learning ability.

### II. DESIGN STRATEGY OF PARADIGM TEACHING

Take the implementation of paradigm teaching of "Linear Algebra" as basic mathematics course of Guizhou University of Finance and Economics as an example, choose combination of proper teaching methods and build teaching design to arouse students' enthusiasm in learning and urge them to participate in the whole teaching process as well as improve their independent learning ability. In class, teachers should combine multimedia teaching with traditional blackboard writing to

[1]National Science Foundation of China (NO.11561012);

[2]Fund project of Department of Science and Technology of Guizhou province (J [2014]2045, [2016]1021)

[3]2014 teaching quality and teaching reform project of Guizhou University of Finance and Economics..

enrich teaching contents and improve teaching efficiency. In order to better arouse students' enthusiasm of learning, in the first class, the teacher group students and assign group leaders who organize and urge group members to learn and communicate with teachers about learning situation and problems. Meanwhile, organize students to establish discipline learning group so that they can timely find teachers to reflect learning situation and solve problems and establish platforms of course learning to experience and make progress together.

#### A. Design of Teaching Links

(1) Design before class. After each class is over, the preview plan is assigned. For conceptual contents, students require to line keywords and grasp the concepts through examples in the textbook; for methodological contents, introduce problems and assign exercises. Students try to solve problems through examples, which can stimulate their thirst for knowledge and curiosity. Teachers can check randomly in the next class to urge students to treat the preview seriously. Preparing lessons before class is indispensable because it trains students' ability to learn new knowledge and make preparations for teachers to teach new lessons and improves classroom efficiency.

(2) Design in class. For conceptual contents, because students have finished the preview, teachers let students experience concepts through examples. If calculation is involved, students require finishing it independently and finding more connotations of concepts through exploration. For methodological contents, teachers only need to demonstrate one example. If extended questions exist, teachers lead students to analyze ways of solving problems instead of detailed calculations. Students are asked to finish on the blackboard and the teacher comments on and appraises as well as takes records.

After the contents of new lesson are finished, teacher assign one to two exercises and ask students to discuss and finish in class. With enough time, students are asked to finish on the blackboard and the teacher comments on and appraises as well as takes records. Teacher can supplement comprehensive questions to stimulate their thirst for knowledge, briefly introduce the method and ask students to finish it as homework.

Before each class is over, five to ten minutes are left for students to discuss within groups. For typical questions, teacher can propose in class and guide students to answer.

(3) Design after class. Assign supplementary exercises and exercises in the textbook. After students are assigned to answer it and upload to the learning group through photographing, teacher comments on and takes records. If reviewing exercises exist in end of term, each group must finish it and upload to the learning group.

#### B. Principle of Achievement Evaluation

Paradigm teaching emphasizes the learning process and lets students' sense of gain and satisfaction. In order to achieve distinction for the group, students are enthusiastic to participate. Therefore, the composition of comprehensive performance must fully mobilize students' subjective initiative. The comprehensive performance evaluation designed by us

includes three aspects, namely checking attendance, learning process (group discussion, class exercise, quiz, assignment and answering questions by groups) and examination, which account for 10 percent, 20 percent and 70 percent respectively. Therefore, teacher timely records students' class exercise, or exercise on the blackboard, or completion of exercises and uploading it to the group or homework completion as basis to score usual performance.

#### C. Effects after Implementing Paradigm Teaching Strategy

(1) Students have stronger sense of responsibility in learning. Integrate students with groups, score of group with personal performance and let students answer questions. Self-respect will drive students to spare no pains to fulfill the task. Students value honor of the group and are unwilling to lag behind, so they will participate in learning more actively. For example, students request to join in another group because members of that group are more active and full of positive energy. It shows the mechanism that integrates students with group stimulates students and lets them think the force of example.

(2) Degree of participation in the class improves obviously. The integration of learning process in usual performance greatly stimulates students' enthusiasm of class participation. Most students can interactive timely, discuss and exercise in class. At the meantime, students' ability of error correction and questioning is improved obviously through class participation. They can find teachers' clerical error or misprint in the textbook. The spirit of daring to doubt is rare and commendable and promotes students' integrated development.

(3) Students are urged to make the best of learning time after class. First, in preview, leading in through exercises makes students have objectives in preview and corrects their bad habits of being indolent after class. Second, teacher has clear requirements for homework. Students must finish representative exercises of certain amount. They have to supplement if failing to finish, or it will influence usual performance. It breaks the misunderstanding that "It's ok if they hand in the homework" and corrects students' attitude towards learning.

(4) Comparative analysis of students' performance. In the basic mathematics course of linear algebra, analyze performance of 870 students major in economic management. A group has 750 students who receive traditional teaching or other paradigm teaching; B group has 120 students who receive this paradigm teaching. The final exam results of students in the two groups are as follows: in A group, students have average score  $\bar{x} = 46.21$ , and sample variance  $s_1^2 = 19.43^2$ ; in B group, students have average score  $\bar{y} = 48.99$ , and sample variance  $s_2^2 = 15.06^2$ . The test method of large sample is adopted, with significant level of 0.1 and quantile of  $U_{0.05} = 1.65$ .

Hypothesis testing of  $H_0: \mu_1 = \mu_2$ ;  $H_1: \mu_1 \neq \mu_2$  is carried out for students of two groups. Calculate and check the statistics:

$$|U| = \frac{|\bar{x} - \bar{y}|}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}} = \frac{2.78}{\sqrt{\frac{19.43^2}{750} + \frac{15.06^2}{120}}} = 1.80 > 1.65$$

reject  $H_0$ . The average scores of students in the two groups have obvious difference.

### III. DISCUSS EVALUATION INDEX OF PARADIGM TEACHING

The selection of evaluation index pays equal attention to teaching process and learning effectiveness. [10] Considering the testability of index, establish index through students' enthusiasm in class participation, degree of participating in discussion and exercise and examination performance and endow each index with corresponding proportion.

#### A. Attendance Rate

Suppose attendance rate is  $X_1$  and the proportion is 30 percent. The attendance rate refers to the percentage that the number of students who attend class accounts for the total number of students. Attendance rate embodies students' learning enthusiasm. Taking attendance rate as evaluation index is objective. Supervisor or the dean's office samples randomly.

#### B. Class Participation Rate

Suppose class participation rate is  $X_2$  and the proportion is 30 percent. Class participation refers to the percentage that the number of students who participate in the discussion and exercise accounts for the total number of people. The class participation rate embodies students' learning enthusiasm and subjective initiative. Supervisor or the dean's office samples randomly.

#### C. The Percentage That the Number of Class with Average Scores to Which Students' Average Score of This Class Exceeds Account for the Total Number of Class in the Grade

Suppose the percentage is  $X_3$  and the proportion is 40 percent. The index shows the ranking of students' performance in the whole grade. Using the relative position of ranking to show performance is superior to using of absolute value of score. It is measured according to the percentage that the number of class with average scores to which students' average score of this class exceeds account for the total number of class in the grade. Because students learn and communicate in the discussion group, discuss and raise questions after class, examination performance roundly reflects students' learning effects and accounts for large proportion.

Index  $L$  is established to show paradigm teaching effects, namely

$$L = X_1 \cdot 100 \cdot 30\% + X_2 \cdot 100 \cdot 30\% + X_3 \cdot 100 \cdot 40\%$$

obviously,  $0 \leq L \leq 100$ . For example, suppose attendance rate is 0.95, class participation rate is 0.85 and the average score of

final examination exceeds that of 80 percent classes in the whole grade, and then

$$L = 0.95 \cdot 100 \cdot 30\% + 0.85 \cdot 100 \cdot 30\% + 0.8 \cdot 100 \cdot 40\% = 86$$

### IV. CONCLUSION

In May 2015, General Office of the State Council issued "Implementation Opinions on Deepening the Educational Reform of Innovation and Entrepreneurship in Universities" [11]. The country pays attention to training innovative applied talents with critical spirit. Because talents are trained in universities, teaching design is important. It proposes universities shall carry out heuristic, discussion and participative teaching, train students' critical and creative thinking and stimulate inspiration of innovation and entrepreneurship as well as provide more colorful educational resources for students' independent learning. Reform contents and ways of examination, check students' ability of analyzing and solving problems through knowledge, explore examination with non-standard answer to avoid "high scores and low abilities". The document indicates directions of educational reform in universities and proposes abandoning the tradition that takes examination as the only standard to measure talents. Teachers and students should change the idea of "teach for teaching and learn for learning". Attentions must be paid to students' integrated development. Meanwhile, we should train students' ability of positive thinking and problem handling, the spirit of daring to try and doubt and the skills of cooperating with partners. Students should learn professional knowledge. More importantly, they know how to learn and grow bravely and positively both within university walls and beyond. Therefore, teachers lay equal stress on strategy and supervision, create opportunities for students to participate in learning and let them accumulate learning pattern and build confidence so that they will hold positive attitudes to new problems and environment. Like the old saying, "Give a man a fish and you feed him for a day. Teach a man to fish and you feed him for a lifetime", university teachers should set good examples and make progress with students through exploration.

### REFERENCES

- [1] Wang Dao Jun, Wang Hanlan. Pedagogy [M], Beijing: People's Education Press, the 2nd edition in 1989
- [2] Same as [1]
- [3] Same as [1]
- [4] Gerald C.Gannod, Janet E.Burge, Michael T.Helmick. Using the Inverted Classroom to Teach Software Engineering
- [5] Miao Jingmin, Wang Qiong. Flipped Classroom in Universities: Current Situation, Effects and Challenges-Investigation on Front Line Teachers [J], Open Education Research, the 5th issue of the 21st volume in October 2015: 74-82
- [6] Sun Juan. Theoretical Discussion on "Participatory Teaching Method" [J], Journal of Liaoning Normal University (Social Science Edition), the 1st issue in 1993: 23-26
- [7] Ma Lihui. Thinking and Paths of Teaching Paradigm Transformation in Universities [J], Foreign Language and Literature, S1 issue in June 2013, 186-188

- [8] Hu Yan. From Objectivity to Construction: Research on Classroom Teaching Paradigm and Its Reform in Universities [D], Hunan University, 2007
- [9] Same as [7]
- [10] Li Xin. Research on Evaluation System of Teaching Quality in Flipped Classroom—Refer to the Evaluation Criterion of CDIO Teaching Model [J], E-education Research, the 3rd issue in 2015: 96-100
- [11] Website of Central People's Government. Implementation Opinions of General Office of the State Council on Deepening the Educational Reform of Innovation and Entrepreneurship in Universities [EB/OL] <http://news.163.com/15/0513/10/APG4RUVR00014SEH.html> May 2015