Construction on the Evaluation Index System of Teaching Effect of “Large Class Teaching and Small Class Discussion”

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Abstract. Constructing the evaluation index system of teaching effect of “large class teaching and small class discussion” and evaluating the teaching effect of this kind of course scientifically and reasonably is an effective means to improve the teaching quality of this kind of course and to smoothly popularize and apply this kind of teaching mode. This paper constructs the theoretical model of the evaluation index system of teaching effect, and optimizes the index system by using factor analysis method through questionnaires. The optimized index system has certain reference value for the evaluation of teaching effect of “large class teaching and small class discussion” in Colleges and universities.

Introduction

In recent years, colleges and universities in China began to carry out “large class teaching, small class discussion” teaching mode. In autumn 2012, Peking University piloted six basic courses for Junior Undergraduates in five basic science academies[1]. In 2015, Fudan University began to carry out at least five small-class seminars on its general education curriculum outside the large classes. About 3500 students in each class will undergo at least 10 small-class seminars on two courses[2]. More than 300 courses in Dalian University of Technology have realized the teaching mode of “large class teaching and small class discussion”[3]. The author's China Jiliang University started the project of “large class teaching and small class discussion” in 2013. So far, more than 50 courses have carried out the “small class discussion” attempt. With the successful implementation of the pilot courses, it is believed that “large class teaching, small class discussion” will become the mainstream teaching mode in domestic universities in the future.

Some researchers have studied the teaching process and teaching effect of “large class teaching, small class discussion”[1,2,4]. Based on the current research, it can be seen that “large class teaching and small class discussion” is a more effective teaching mode than traditional large class teaching. It is more conducive to stimulating students’ learning initiative, creativity and potential, strengthening teacher-student interaction, and fully mobilizing the dual-subject role of “teacher-student”. But there are also some problems such as the change of teachers’ roles, the weakness of teachers, the shortage of hardware resources and the difficulty of evaluation. At the same time, the effect of small class discussion teaching is influenced by teachers' teaching ability, students' input behavior, discussion organization mode, discussion theme and other factors, which makes the effect of small-class discussion teaching different among different teachers, different students and different courses. Therefore, Constructing the evaluation index system of teaching effect of “large class teaching and small class discussion” and evaluating the teaching effect of this kind of course scientifically and reasonably is an effective means to improve the teaching quality of this kind of course and to apply this kind of teaching mode.

At present, the research on the evaluation index system of teaching effect mainly focuses on the traditional large class teaching method. For example, Meng Qingmao and Lin Wenyin revised the “Student Evaluation of Education Quality” (SEEQ) designed by Professor H.W. MARSH abroad to form the “College Teachers’ Teaching Effectiveness Evaluation Questionnaire” (Chinese version SEEQ) [5]. In the teaching mode of combination of large and small classes, the quality of small class discussion is the main factor affecting the overall
teaching effect, while the current evaluation index of teaching effect is aimed at the traditional large class. If we use it to evaluate the teaching effect of “large class teaching, small class discussion”, there will be a big deviation in the result. According to the comprehensive literature, there is no research on the evaluation index system of the teaching effect of the combination of large and small classes in China. The evaluation of this kind of curriculum in the author’s university is mainly through the way of expert evaluation, and the evaluation results are subjective. The current evaluation index system of teaching effect emphasizes that students are the main body of evaluation, and the main role of students in the combination of large and small classes is more prominent. Therefore, this paper attempts to study and construct the evaluation index system of teaching effect of “large class teaching and small class discussion” for students, in order to make the evaluation more objectively and scientifically.

**Theoretical Model**

The evaluation of the teaching effect of “large class teaching and small class discussion” should integrate the teaching quality of large class teaching and the effect of small class discussion as well as the effective combination of large class and small class. Therefore, this study refers comprehensively to the Chinese version of SEEQ, the results of empirical research in the previous literature on “small class discussion” and the author's own teaching in such courses. On the basis of summing up the experience in learning practice, this paper constructs a theoretical index system for evaluating the teaching effect of “large class teaching, small class discussion” with students as the evaluation subject, as shown in Table 1. The theoretical index system consists of 7 first-level indicators and 26 second-level indicators.

**Optimization of the Theoretical Model**

Whether the theoretical model is reasonable and feasible needs to be verified and optimized by empirical research method.

**Questionnaire Investigation**

Empirical research mainly adopts quantitative research method and questionnaire survey. According to the Second-level indicators in the theoretical model (i.e. measurement indicators), the corresponding investigation questions are designed. For example, the corresponding test questions of “Intelligibility of teaching contents in large classes” are “teaching contents in this course are clear, intelligible and easy to accept”. 26 secondary indicators formed 26 survey questions. The survey questions were assessed by “Lickert Scale”. The options were consent, comparative consent, general consent, disagreement and disagreement. The scores ranged from 1 to 5, of which “consent” was 5 points, and “disagreement” was 1 point by analogy. A total of 200 questionnaires were sent out. The respondents were students who had participated in a round of “large class teaching, small class discussion” courses in China Jiliang University. The courses covered different types of science and technology, humanities and so on. Finally, 200 valid questionnaires were collected. The reliability of questionnaire data was analyzed by SPSS software. The result of reliability test shows that the Alpha coefficient of the total questionnaire is 0.969, which indicates that the questionnaire has high reliability. The CITC values of each item are greater than 0.3, indicating that there are no items to be deleted. The results of the questionnaire can be used for further data analysis.
Table 1. Theoretical Indicator System of Teaching Effectiveness Evaluation of “Large Class Teaching and Small Class Discussing”.

| First-level indicators | Second-level indicators |
|------------------------|-------------------------|
| Teaching contents      | Intelligibility of teaching contents in large classes(Q1) |
|                        | Difficulty of teaching and seminar contents(Q2) |
|                        | Linkage between teaching content and seminar content in large classes(Q3) |
|                        | Coverage of seminar content to major knowledge points of the course(Q4) |
| Teaching process       | Hours allocation for large class teaching and small class discussion(Q5) |
|                        | Diversity of course assignments and practice forms(Q6) |
| Teaching organization  | Arrangement of the number of discussants in small classes(Q7) |
|                        | Hardware facilities of Small class discussion room(Q8) |
|                        | Teachers’ organizing and coordinating ability(Q9) |
|                        | Diversity of organizational forms in small classes(Q10) |
| Knowledge deepening    | Deep understanding of knowledge points in large class teaching(Q11) |
|                        | Widening knowledge and visual field(Q12) |
|                        | Understanding of frontier knowledge of discipline(Q13) |
| Teacher-student interaction | Participation of students(Q14) |
|                        | Communication between teachers and students(Q15) |
|                        | Teachers’ summary of discussion contents(Q16) |
|                        | New perspectives, positions and ways of thinking(Q17) |
|                        | Raising new questions(Q18) |
| Ability improvement    | Autonomous learning ability(Q19) |
|                        | Oral expressive ability(Q20) |
|                        | Ability to discover, analyze and solve problems(Q21) |
|                        | Ability to identify and integrate different perspectives(Q22) |
|                        | Spirit of cooperation(Q23) |
| Emotional attitudes    | Interest and enthusiasm in curriculum learning(Q24) |
|                        | Pleasure(Q25) |
|                        | Fulfillment(Q26) |

Factor Analysis

Factor analysis is a mathematical method for dealing with multivariate data. It can reveal the relationship between multi-variables. Its main purpose is to generalize and deduce a few “factors” from a large number of observable “variables”, and to use the least “factors” to generalize and explain the largest number of observation facts, thus establishing the most concise and basic conceptual system and revealing the most fundamental between things. Therefore, the data processing of this empirical study is completed by factor analysis.

(1) KMO Test and Bartlett Test

KMO test and Bartlett test are two practical methods to test whether variables are suitable for factor analysis. The test results show that the KMO value is 0.916, greater than 0.8, which indicates that the data is very suitable for factor analysis. At the same time, the corresponding P value of Bartlett test is less than 0.05, which also indicates that factor analysis is suitable.

(2) Factor Extraction

Factor analysis was carried out on 26 variables for 200 valid samples. Through factor analysis, six main factors were extracted, and their eigenvalues were all greater than 1. The information coverage rate of the original data reached 78.935%. Therefore, it can be considered that these six factors are the main factors that constitute the 26 item variables of the questionnaire, which is one less than the seven main factors of the theoretical model.
The maximum variance rotation method is used to rotate the research data, and the items with high load on each main factor are obtained, as shown in Table 2. The absolute value of factor load coefficient in the table is more than 0.4, which indicates that the index has a corresponding relationship with the factor. When an index corresponds to multiple factors, it is necessary to determine which factor should belong to according to the specific situation. For example, the index Q13 (Understanding of frontier knowledge of discipline) in the table corresponds to factor 1 (0.439) and factor 2 (0.53). After comprehensive judgment, Q13 is more related to other indicators belonging to factor 1, so it belongs to factor 1.

Table 2. Factorial Load Matrix after Rotation.

| Index | Factor 1 | Factor 2 | Factor 3 | Factor 4 | Factor 5 | Factor 6 |
|-------|----------|----------|----------|----------|----------|----------|
| Q11   | 0.626    | 0.124    | 0.326    | 0.361    | 0.284    | 0.267    |
| Q12   | 0.771    | 0.16     | 0.197    | 0.05     | 0.171    | 0.252    |
| Q13   | 0.439    | 0.53     | 0.214    | -0.014   | 0.345    | 0.19     |
| Q17   | 0.522    | 0.214    | 0.295    | 0.36     | 0.301    | 0.341    |
| Q19   | 0.526    | 0.262    | 0.124    | 0.548    | 0.256    | 0.216    |
| Q21   | 0.724    | 0.099    | 0.286    | 0.329    | 0.093    | 0.051    |
| Q22   | 0.654    | 0.246    | 0.314    | 0.298    | 0.174    | 0.252    |
| Q23   | 0.566    | 0.448    | 0.018    | 0.442    | 0.097    | 0.146    |
| Q24   | 0.748    | 0.135    | 0.246    | 0.247    | 0.316    | 0.148    |
| Q25   | 0.735    | 0.454    | 0.202    | 0.135    | 0.116    | 0.046    |
| Q26   | 0.679    | 0.468    | 0.341    | 0.213    | 0.175    | 0.066    |
| Q5    | 0.157    | 0.748    | 0.247    | 0.14     | 0.31     | 0.216    |
| Q6    | 0.231    | 0.587    | 0.496    | 0.33     | 0.143    | 0.062    |
| Q7    | 0.264    | 0.775    | 0.151    | 0.327    | -0.068   | 0.274    |
| Q9    | 0.275    | 0.472    | 0.348    | 0.34     | 0.444    | 0.213    |
| Q1    | 0.435    | 0.133    | 0.78     | 0.073    | 0.063    | 0.179    |
| Q2    | 0.399    | 0.158    | 0.733    | 0.16     | -0.01    | 0.081    |
| Q3    | 0.112    | 0.265    | 0.633    | 0.291    | 0.184    | 0.455    |
| Q4    | 0.062    | 0.267    | 0.684    | 0.183    | 0.473    | 0.005    |
| Q14   | 0.547    | 0.478    | 0.045    | 0.433    | 0.208    | -0.1     |
| Q15   | 0.239    | 0.13     | 0.215    | 0.772    | 0.173    | 0.223    |
| Q16   | 0.248    | 0.495    | 0.291    | 0.674    | 0.165    | 0.036    |
| Q20   | 0.432    | 0.335    | 0.248    | 0.478    | 0.23     | -0.025   |
| Q10   | 0.376    | 0.346    | 0.356    | 0.177    | 0.583    | 0.153    |
| Q18   | 0.463    | 0.101    | 0.034    | 0.334    | 0.717    | 0.07     |
| Q8    | 0.284    | 0.268    | 0.189    | 0.149    | 0.089    | 0.782    |

According to the results of Table 2, the theoretical model of the index system was reconstructed and adjusted, from the original seven main factors to six main factors. The corresponding relationship between the second-level index and the main factor was reconstructed according to the results of Table 2, and the six main factors were renamed combined with the content of the second-level index. Finally, the optimized evaluation index system of teaching effect of “large class teaching and small class discussion” was obtained, as shown in Table 3.
Table 3. Optimized Evaluation Index System.

| First-level indicators | Second-level indicators |
|------------------------|-------------------------|
| Knowledge, ability     | Deep understanding of   |
| and emotion            | knowledge points in     |
|                        | large class teaching(Q11)|
|                        | Widening knowledge and  |
|                        | visual field(Q12)       |
|                        | Understanding of        |
|                        | frontier knowledge of   |
|                        | discipline(Q13)         |
|                        | New perspectives,       |
|                        | positions and ways of   |
|                        | thinking(Q17)           |
|                        | Autonomous learning     |
|                        | ability(Q19)            |
|                        | Ability to discover,    |
|                        | analyze and solve       |
|                        | problems(Q21)           |
|                        | Ability to identify and |
|                        | integrate different     |
|                        | perspectives(Q22)       |
|                        | Spirit of cooperation(Q23)|
|                        | Interest and enthusiasm |
|                        | in curriculum learning(Q24)|
|                        | Pleasure(Q25)           |
|                        | Fulfillment(Q26)        |
| Teaching organization  | Hours allocation for    |
|                        | large class teaching and|
|                        | small class discussion(Q5) |
|                        | Diversity of course     |
|                        | assignments and practice|
|                        | forms(Q6)               |
|                        | Arrangement of the      |
|                        | number of discussants   |
|                        | in small classes(Q7)    |
|                        | Teachers’ organizing    |
|                        | and coordinating        |
|                        | ability(Q9)             |
| Teaching contents      | Intelligibility of      |
|                        | teaching contents in    |
|                        | large classes(Q1)       |
|                        | Difficulty of teaching  |
|                        | and seminar contents(Q2)|
|                        | Linkage between         |
|                        | teaching content and    |
|                        | seminar content in      |
|                        | large classes(Q3)       |
|                        | Coverage of seminar     |
|                        | content to major        |
|                        | knowledge points of     |
|                        | the course(Q4)          |
| Teaching interaction   | Participation of        |
|                        | students(Q14)           |
|                        | Communication between   |
|                        | teachers and students(Q15) |
|                        | Teachers’ summary of    |
|                        | discussion contents(Q16) |
|                        | Oral expressive ability(Q20)|
| Form of discussion     | Diversity of           |
|                        | organizational forms in |
|                        | small classes(Q10)      |
|                        | Raising new questions(Q18)|
| Hardware support       | Hardware facilities of  |
|                        | Small class discussion  |
|                        | room(Q8)                |

Conclusion

The teaching mode of “large class teaching and small class teaching” will gradually become the mainstream teaching mode in Colleges and universities. Scientific and reasonable evaluation of the teaching effect under this kind of teaching mode is very important to guide teachers to improve teaching quality. Based on the construction of theoretical index system, this paper optimizes and improves the index system through questionnaire survey and factor analysis, and finally obtains a reasonable and feasible evaluation index system of teaching effect of “large class teaching, small class discussion”. The index system can provide reference for the quantitative evaluation of the teaching effect of “large class teaching and small class discussion” course in colleges and universities. At the same time, whether the index system is practical and feasible, the follow-up needs to be verified by examples.

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