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Research on the Cognitive Situation of Pre-Service Mathematics Teachers for Teaching Evaluation of High School Mathematics under the New *Curriculum Standards* in China

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

As an important means to improve teaching quality and teaching level, mathematics teaching evaluation is an important part of mathematics education and teaching. How to use evaluation in the teaching process to effectively improve the quality of classroom teaching and promote the all-round development of students is a problem that all teachers need to think seriously. There have been many related studies on mathematics teaching evaluation, but the cognition situation of pre-service mathematics teachers of teaching evaluation has not been studied. To address this problem, this study investigates the cognition of 25 pre-service mathematics teachers on teaching

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evaluation through open-ended interviews, obtains the cognitive situation of pre-service mathematics teachers on mathematics teaching evaluation, and puts forward targeted suggestions for training pre-service mathematics teachers. After analyzing, it can be found that: (1) Pre-service teachers' cognition of the function, principle, and implementation strategy of teaching evaluation is not comprehensive enough, and there is a big gap with the previous research (2) Pre-service teachers' understanding of teaching evaluation is highly matched with the previous research, but there is still a certain one-sidedness, and the feasibility and effectiveness of some views need to be verified. Therefore, it is suggested that: (1) Teachers and experts responsible for training should provide more off-campus internship opportunities for pre-service teachers; (2) Pre-service teachers should take the initiative to study and research, learn the relevant evaluation methods and latest evaluation theories and try to combine the evaluation methods with the relevant contents of high school mathematics.

Keywords: Pre-service teachers; mathematics teaching evaluation; cognitive level.

1. INTRODUCTION

Teaching evaluation refers to the process of comprehensive, comprehensive, and objective value judgment of the teaching process and its results according to certain curriculum concepts and teaching objectives. As an important means of education reform and improving teaching quality and teaching level, it aims to comprehensively and objectively measure teachers' teaching situation, improve teaching behavior, and improve teaching efficiency [1]. The promulgation of the *Mathematics Curriculum Standards for Ordinary High Schools (2017 Edition)* (hereinafter referred to as the *Curriculum Standards(2017 Edition)*) also emphasizes the important position of teaching evaluation in teaching, and puts forward many suggestions for teaching evaluation in ordinary high schools. Teachers' reasonable and correct evaluation in teaching is an important prerequisite for improving teaching quality [2]. However, many scholars and teachers have studied and discussed the current situation of high school mathematics teaching evaluation, it is concluded that many high school teachers still adopt the old evaluation method, and there are some problems such as paying too much attention to grades and adopting a single evaluation method when evaluating students' learning [3]. So, how to carry out reasonable teaching evaluation in high school mathematics classroom ? What kind of teaching evaluation can promote the development of students and improve the quality of teaching? These questions are worth studying.

2. LITERATURE REVIEW

Currently, there have been many studies on the evaluation of high school mathematics teaching under the new *Curriculum Standards* in China and abroad.

2.1 The Meaning of Mathematics Classroom Teaching Evaluation

The original meaning of evaluation refers to the conclusion after analyzing and judging people or things. Therefore, in essence, evaluation is a process of value judgment [1]. The Center for Basic Education and Teaching Research of Beijing Academy of Education and Science believes that classroom teaching evaluation is a process of value judgment on many factors and developments in classroom teaching, which is based on the realization of educational goals, that is, to promote the overall development of students as the ultimate goal, based on teaching goals and relevant teaching theories, and using operational scientific means [4]. Lu JZ and Zhang J believe that mathematics classroom teaching evaluation is an activity that takes one (or several) mathematics classroom teaching as the research object, and uses scientific evaluation methods to make value judgments on the effects of teaching and learning according to the evaluation criteria [5].

2.2 The Content of Classroom Teaching Evaluation

Ma YP summarized several basic characteristics of primary and secondary school classroom evaluation in *Mathematics Education Evaluation* [6] : (1) Determine the actual content scope and difficulty requirements ; (2) Create a relaxed and harmonious learning environment for students ; (3) Pay attention to students' learning process, so that students have the opportunity to experience mathematics ; (4) Respect the needs of students, protect students' self-esteem and

self-confidence ; (5) Use flexible methods to adapt to students' actual and content requirements ; (6) Leave space for students to think. Yu P, Professor of Nanjing Normal University, published a series of articles in *Middle School Mathematics Teaching Reference,* and studied how to evaluate the course from the aspects of mathematics teaching content organization and mathematics teaching objectives, the various aspects of mathematics classroom teaching evaluation were specifically divided, and a hierarchical evaluation standard was designed [7-11]. Zong J proposed that classroom teaching evaluation should evaluate whether students can apply the knowledge to solve practical problems, students' learning status, emotions, attitudes and values [12]. Song LY pointed out that teaching evaluation should focus on the development of students' core qualities and the organic integration of "four bases" and "four abilities" with core qualities [13] Ping Y proposed that teaching evaluation should be carried out in the perspective of the integration of the five domains of educations (moral education, intellectual education, physical education, aesthetic education and labour education),focusing on cultivating well-rounded individuals with personality traitsts [14].

2.3 Methods of Teaching Evaluation

There are many methods of teaching evaluation, such as scale evaluation method, portfolio method, comment evaluation method, academic performance report method, oral report method and so on. In the field of educational research, scholars mostly use scale evaluation method, investigation and evaluation methods (observation method, interview method, test method, questionnaire survey method) to study.

The most widely used is the scale evaluation method. The determination of the evaluation scale and the processing method of the data after evaluation have become the main aspects of education evaluation research. The formulation of evaluation scale mainly depends on the various factors of classroom teaching (teaching objectives, teaching process, teaching methods, teaching effects, etc.), students' learning behavior (students' emotional state, participation status, etc.) and the overall characteristics of the classroom (classroom atmosphere, classroom culture, classroom openness, etc.) [15]. In order to make the data obtained from the evaluation more reasonable and scientific, the researchers have also conducted a lot of research on the processing methods of the data. Fan LZ proposed the principal component and factor analysis method to find out a few variables to describe the relevant multiple indicators [16]; Mu YQ put forward the Fuzzy mathematical comprehensive evaluation model to calculate the classroom score[17].Yan SF, Xiong ZQ and Wang B put forward the evaluation model of "three stages and four dimensions" based on the core literacy[18].

In recent years, due to the rapid development of information technology, researchers have introduced computer technology into classroom evaluation. Luo ZY and Zhang DH proposed that the teaching information in the classroom can be processed automatically so as to carry out automatic teaching evaluation[19].Wu LB, Cao YN and Cao YM put forward the application of artificial intelligence technology to classroom teaching evaluation, and constructed a classroom teaching evaluation framework under artificial intelligence[20].

2.4 Principles of Teaching Evaluation

Jiang SF believes that the purpose of evaluation is to promote students' learning, improve teachers' teaching, and achieve the fundamental goal of promoting teachers' professional development and students' literacy development, teaching evaluation should follow the following principles: holistic principle, people-oriented principle, development principle and operability principle[21]. Zhu M proposed that teaching evaluation should follow principles of development, student-centered and comprehensive [22]. Fei YW believes that teaching evaluation should follow the principles of development, diversification, and attention to the nature of mathematics [15]. In Jia LP's opinion, the evaluation of high school mathematics teaching should follow the principles of development, student-centered, comprehensiveness and discipline[23]. Jia YY believes that teaching evaluation should adhere to the principles of feasibility, science, development and objectivity[24]. The *Curriculum Standards (2017 Edition)* proposes that daily teaching evaluation should follow the following principles: 1.Pay attention to the achievement of students' core literacy in mathematics ; 2.Pay attention to the integrity and stage of evaluation ; 3.Pay attention to process evaluation ; 4.Pay attention to students' learning attitude[2].

It can be seen from the above research that many scholars have done a lot of research on the meaning, content, methods and principles of high school mathematics teaching evaluation, mainly focusing on the supplement and discussion of various aspects of teaching evaluation. There is little research on the cognition and understanding of the current teaching evaluation advocated by pre-service teachers. Teachers' cognition of teaching evaluation greatly affects the achievement and quality of teaching evaluation objectives. Therefore, this paper aims to find out the current pre-service teachers' cognition of teaching evaluation under the *Curriculum Standards(2017 Edition)* through investigation. Therefore, the research question of this paper is:

1. What are the main aspects of pre-service teachers' cognition of the function, principle and implementation of teaching evaluation under the *Curriculum Standards(2017 Edition)* ?
2. Is the current pre-service teachers' understanding of how to implement the teaching evaluation under the *Curriculum Standards(2017 Edition)* comprehensive ?
3. Is the current pre-service teachers' understanding of the teaching evaluation under the *Curriculum Standards(2017 Edition)*reasonable ?

3. METHODS

3.1 Sample Analysis

In this study, 25 masters of education in the School of Mathematics and Statistics of Shandong Normal University were selected as the survey subjects, including 2 males and 23 females. They all hold a mathematics teacher qualification certificate and have the intention to teach in high school. Taking them as the object of investigation can truly reflect the current pre-service mathematics teachers' cognition of the teaching evaluation under the *Curriculum Standards (2017 Edition)*.

3.2 Survey Instrument

This study uses an open-ended interview method to investigate, and the interview outline is designed with three questions: "What do you think of the role of mathematics teaching evaluation in high school?", "What principles do you think should be adhered to in high school mathematics teaching evaluation?", "In order to implement the mathematics teaching evaluation under the *Curriculum Standards (2017 Edition)*, how do you think it should be done in specific teaching". The open-ended interview method is adopted because it is fast, convenient, flexible, and not restricted by written language, and it facilitates in-depth investigations to obtain the most direct information.

3.3 Data Collection

To ensure the reliability of the research, this study uses an open-ended interview method to interview 25 pre-service mathematics teachers one by one individually. In addition, the whole interview content is recorded during the whole process after the consent of the survey object is sought.

3.4 Data Processing

Turn the interview recording into text, remove modal particles such as um, ah, and organize them in strict accordance with the original interview dialogue. Refining the core views expressed by the interviewees. The interview results are divided into three aspects: "the function of teaching evaluation", "the principle of teaching evaluation" and "the implementation strategy of teaching evaluation", which are coded with A, B and C respectively. Then, count the number of people mentioned in the content under each aspect, calculate the corresponding percentage, and the statistical table is made.

4. RESULTS

4.1 Cognitive Content

Extracted the core viewpoints of the pre-service teachers' answers to the three questions, there are 8 points in the function of teaching evaluation, 19 points in the principle of teaching evaluation, and 15 points in the implementation strategy of classroom teaching evaluation.

For the cognition of the dimension of "the functions of teaching evaluation", pre-service teachers answered a total of 8 items. Their understanding mainly focused on the " improvement function" of the evaluation, a total of 23 people, accounting for 92.00 % of the total number; followed by the "feedback function", a total of 18 people, accounting for 72.00 % of the total number ; again for the "diagnostic function", a total of 15 people, accounting for 60 % of the total number ; then the "incentive function", a total of 15 people, accounting for 28 % of the

Table 1. Pre-service teachers' cognition of the function of mathematics teaching evaluation

Category	Label	Content	Number	Percentage
A Teaching Evaluation Functions	A1	Improvement Function	23	92.00
	A2	feedback Function	18	72.00
	A3	Research Function	1	4.00
	A4	Diagnostic Function	15	60.00
	A5	Incentive Function	7	28.00
	A6	Reflection Function	2	8.00
	A7	Guiding Function	3	12.00
	A8	Supervision Function	1	4.00

total number. It can be seen that pre-service teachers can realize the important function of teaching evaluation for mathematics classroom teaching, and the cognition of teaching evaluation function mainly focuses on the evaluation of the quality effect of the whole classroom teaching and students' learning and the improvement of the whole classroom quality, which is consistent with the goal of teaching evaluation mentioned in the *Curriculum Standards(2017 Edition)*. Details are shown in Table 1.

For the cognition of the dimension of "the principles of teaching evaluation", pre-service teachers answered a total of 19 items. Its cognitive content mainly focuses on the "diversity principle" of evaluation, which is mentioned by 19 people, accounting for 76 % of the total number. Followed by the "comprehensive principle", a total of 15 people mentioned, accounting for 60% of the total number; again is the "validity principle", a total of 12 people mentioned, accounting for 48 % of the total number ; then the "developmental principle", which is mentioned by 11 people, accounting for 44 % of the total number. From the above data, it can be seen that pre-service teachers have some thoughts on the principles that should be adhered to in teaching evaluation. They believe that teaching should be evaluated comprehensively, pluralistically and effectively, and the content of evaluation is not only the mastery of students' knowledge and skills but also the development, ability and attitude of students. Details are shown in Table 2.

Table 2. Pre-service teachers' cognition of the principles of mathematics teaching evaluation

Category	Label	Content	Number	Percentage
B Principles of Teaching Evaluation	B1	Principle of objectivity	11	44.00
	B2	Principle of comprehensiveness	15	60.00
	B3	Operability principle	3	12.00
	B4	The principle of pluralism	19	76.00
	B5	Process principle	8	32.00
	B6	Principle of effectiveness	12	48.00
	B7	Guiding principle	2	8.00
	B8	The principle of integrity	4	16.00
	B9	Student-oriented principle	3	12.00
	B10	Value principle	1	4.00
	B11	Meticulous	2	8.00
	B12	Pay attention to students' learning attitude	3	12.00
	B13	Developmental principle	11	44.00
	B14	The principle of personalization	6	24.00
	B15	The principle of timeliness	2	8.00
	B16	Dynamic principle	1	4.00
	B17	Focus on the development of students' core literacy	6	24.00
	B18	Give full play to the incentive role of evaluation	2	8.00
	B19	Assess students' ability development	1	4.00

Table 3. Pre-service teachers' cognition of the implementation of mathematics teaching evaluation

Category	Label	Content	Number	Percentage
C The Implementation Strategies of Teaching Evaluation	C1	A combination of multiple evaluation methods	6	24.00
	C2	Diversification of evaluation subjects	5	20.00
	C3	Objective evaluation criteria	4	16.00
	C4	Meet the evaluation objectives	10	40.00
	C5	Focus on the development of students, take the student as the main body	10	40.00
	C6	Timely feedback the evaluation results and improve according to the evaluation results.	13	52.00
	C7	Reflection after evaluation	5	20.00
	C8	Focus on the development of students' core literacy	4	16.00
	C9	Comprehensive and multi-dimensional evaluation	10	40.00
	C10	Pay attention to students' learning process and learning attitude.	7	28.00
	C11	Conduct targeted evaluations	7	28.00
	C12	Focus on periodic evaluation	1	4.00
	C13	Make good use of the incentive effect of evaluation	3	12.00
	C14	Understand the learning situation, do a good job of pre-test	3	12.00
	C15	Taking students as the main body	10	40.0

For the cognition of the dimension of "implementation strategies of teaching evaluation", pre-service teachers' answers have 15 points in total. Its cognitive content mainly focuses on "timely feedback of evaluation results and improvement based on evaluation results" in teaching, with 13 people mentioned, accounting for 52 % of the total number ; secondly, in teaching, we should "conduct comprehensive and multi-dimensional evaluation", "meet the evaluation objectives", "pay attention to the development of students", "take students as the main body", all mentioned by 10 people, accounting for 40 % of the total number ; thirdly, in teaching, we should "pay attention to students", "learning process and learning attitude" and "carry out targeted evaluation", which were mentioned by 7 people, accounting for 28% of the total number. It can be seen from the above data that pre-service teachers realize that teachers should pay attention to timely feedback after evaluation and make improvements based on the feedback. For the content of evaluation, pre-service teachers can realize that teaching evaluation should focus on students' all-round development, learning process, learning attitude and ability. Details are shown in Table 3.

4.2 The Comprehensiveness of Cognition

This study has sorted out the relevant contents of the "functions of teaching evaluation", the "principles of teaching evaluation" and the "implementation strategies of teaching evaluation" put forward by predecessors. In the aspect of "the functions of teaching evaluation", 12 functions of teaching evaluation are put forward by predecessors. In the aspect of "the principles of teaching evaluation", 25 principles are put forward by predecessors. In the aspect of "the implementation strategies of teaching evaluation", 37 contents are put forward by predecessors. The final summary results are shown in Table 4.

By matching the pre-service teachers' cognition of the three dimensions of mathematics teaching evaluation with the contents of previous studies, it can be found that:

In terms of "the functions of teaching evaluation", the predecessors put forward 12 points in total. From the overall level, the respondents recognized 8 points of them, accounting for 66.67% of the total ; from the individual level, the respondents recognized up to 4 items, accounting for 33.33 % of the total, and at least 1

Table 4. The previous research on the function, principle and implementation of teaching evaluation is coded

Category	Label	Content
D The Functions of Teaching Evaluation	D1	Feedback function
	D2	Incentive function
	D3	Diagnostic function
	D4	Guiding function
	D5	Prediction function
	D6	Improve the function
	D7	Management function
	D8	Assessment function
	D9	Supervision function
	D10	Regulating function
	D11	Research function
	D12	Reflective function
E Principles of Teaching Evaluation	E1	Developmental principle
	E2	The principle of combining commonness and individuality
	E3	Pay attention to the principle of the nature of mathematics
	E4	Guiding principle
	E5	Principle of effectiveness
	E6	Operability principle
	E7	Principle of comprehensiveness
	E8	Student-centered principle
	E9	Highlight the key principles
	E10	The principle of independence
	E11	The principle of measurability
	E12	The principle of reflection
	E13	The principle of pluralism
	E14	Pay attention to learning attitude
	E15	Dynamic principle
	E16	Tentative principle
	E17	The principle of participation
	E18	The principle of combination of learning and application
	E19	Scientific principle
	E20	The principle of integrity
	E21	Principle of objectivity
	E22	Comprehensive principle
	E23	The principle of best motivation
	E24	Attach importance to the achievement of students' core literacy in mathematics
	E25	Process principle
F The Implementation Strategies of Teaching Evaluation	F1	Evaluation reflects the teaching goal.
	F2	Pay attention to mathematical thinking method
	F3	Mobilize students' mathematical thinking
	F4	Pay attention to the use of mathematical language
	F5	Pay attention to the main participation of students
	F6	Respect for differences
	F7	Focus on classroom teaching effect
	F8	Facing the whole
	F9	Focus on the learning process
	F10	Leave space for students to think
	F11	Focus on the application of knowledge
	F12	Focus on the all-round development of students
	F13	Reflect the characteristics of mathematics

Category	Label	Content
	F14	Teaching strategies and methods
	F15	Focus on students' core literacy
	F16	Emphasize the professional growth of teachers and harmony between teachers and students.
	F17	Emphasis on teacher-student interaction
	F18	Pay attention to teaching by learning
	F19	Multiple evaluation subjects
	F20	There are various forms of evaluation.
	F21	Focus on the learning process and the evaluation of learning ability
	F22	Combining process evaluation with result evaluation.
	F23	The formulation of evaluation plan should strive to be simple and easy to operate.
	F24	The evaluation process should strive for dynamic development.
	F25	The combination of qualitative evaluation and quantitative evaluation
	F26	The evaluation criteria meet the evaluation objectives.
	F27	Conform to the law of teaching
	F28	Embody personality
	F29	Guide students to participate in the evaluation
	F30	Pay attention to students' classroom performance
	F31	Scientific evaluation
	F32	Evaluation of education
	F33	Feedback adjustment should be timely
	F34	The objectivity of evaluation criteria
	F35	The flexibility of evaluation criteria
	F36	Conduct a comprehensive evaluation
	F37	Create appropriate evaluation opportunities

item, accounting for 8.33 % of the total. In terms of content, pre-service teachers are not aware of the teaching evaluation's functions of "prediction", "management", "assessment" and so on.

In terms of the "principles of teaching evaluation", the predecessors put forward 25 points in total. From the overall level, the respondents recognized 13 points of them, accounting for 52 % of the total; from the individual level, the respondents recognized up to 7 items, accounting for 28 % of the total, and at least 2 items, accounting for 8 % of the total. In terms of content, pre-service teachers are not aware of the teaching evaluation's principles of "paying attention to the nature of mathematics", "highlighting the focus", "independence" and so on.

In terms of the "implementation strategies of teaching evaluation", 37 suggestions have been put forward. From the overall level, pre-service teachers can recognize 11 points of them, accounting for 29.73 % of the total; from the individual level, the respondents recognized up to 6 of them, accounting for 16.22 % of the total, and at least 1 of them, accounting for 2 % of the total. In terms of content, pre-service teachers fail to realize the implementation strategies of "reflecting teaching objectives", "leaving room for students to think", "focusing on the application of knowledge" and so on.

It can be seen that in terms of the "functions of teaching evaluation", the overall cognition of pre-service teachers is relatively comprehensive, but from the individual level, all interviewees' cognition of the functions of teaching evaluation is no more than half of the previous ones, and the comprehensiveness of pre-service teachers' cognition of this aspect needs to be strengthened. In terms of the "principles of teaching evaluation" and the "implementation strategies of teaching evaluation", whether from the overall or individual point of view, pre-service teachers' cognition of these two aspects is not sufficient, which does not reach 60 % of the previous research content, and the difference between personal cognition is large.

4.3 Rationality of Cognition

Comparing the content of pre-service teachers' answers with previous studies, it is considered to be reasonable if the two have the same or similar meaning. Statistics show that:
In terms of "the functions of teaching evaluation", pre-service teachers put forward a total of 8 points, which can match the previous research content. This means that pre-service teachers have a reasonable understanding of the functions of teaching evaluation. All the functions they put forward are consistent with the previous research, such as the "improvement function", "feedback function", "diagnostic function" and so on.

In terms of the "principles of teaching evaluation", pre-service teachers put forward 19 points, of which 13 points matched the previous research, accounting for 68.42 %. In terms of specific content, the "comprehensive principle", "developmental principle", "objective principle" and other contents of teaching evaluation that pre-service teachers pay attention to are consistent with the principles obtained by previous studies, while the "value principle" and "timeliness principle" recognized by pre-service teachers are not involved in previous studies.

In terms of the "implementation strategies of teaching evaluation", pre-service teachers put forward a total of 15 points, of which 11 points matched the previous research, accounting for 73.33 %. In terms of specific content, the implementation strategies of teaching evaluation, such as "diversification of evaluation methods", "diversification of evaluation subjects", "timely feedback and improvement of evaluation results" and so on, recognized by pre-service teachers, are consistent with the previous studies. However, the contents of "understanding learning situation, doing pre-test well" and "making good use of the incentive effect of evaluation" proposed by pre-service teachers are not involved in previous studies.

Therefore, it can be seen that pre-service teachers' understanding of teaching evaluation is reasonable, and the matching degree with the content proposed by predecessors can reach more than 60% in many aspects. However, there are still some contents in their cognition that fail to match the previous research, and the scientificity and effectiveness of these contents need to be further verified. The details are shown in Table 5 [25-26].

5. DISCUSSION

5.1 Cognitive Content

From the above data analysis, it can be seen that for the functions of teaching evaluation, pre-service teachers mainly focus on the functions of the evaluation and improvement of the overall classroom teaching and the effect of students' learning quality, such as "improvement function", "feedback function", "diagnosis function"and so on. They can realize the important role of teaching evaluation in classroom teaching, which is also consistent with the purpose of teaching evaluation mentioned in *Curriculum Standards(2017 Edition)* In addition, some pre-service teachers can also recognize the functions of evaluation, such as " research", "supervision" and "reflection".

For the principles of teaching evaluation, most pre-service teachers can realize that the implementation of teaching evaluation should adhere to the principles of "diversity principle", "comprehensive principle", "development principle" and so on, which are in line with the goal of quality education, and they can also realize the principles of "effectiveness principle", "operability principle", "objectivity principle" and so on, which can ensure the realization of the purpose of evaluation. In addition, pre-service teachers can also realize the principles of "student-oriented" and "paying attention to the development of students' core literacy".

For the implementation strategies of teaching evaluation, pre-service teachers pay more attention to the content and effect of evaluation : evaluate according to the goal of the evaluation, ensure the validity of the evaluation, evaluate comprehensively and multi-dimensionally, and feedback on the evaluation results in time and improve according to the evaluation results. At the same time, pre-service teachers also emphasize the important position of students in teaching evaluation : to evaluate with students as the main body, and to pay attention to the changes in students' core literacy, but also to pay attention to students' learning attitude and learning process .

5.2 The Comprehensiveness of Cognition

From the above data analysis, it can be seen that in the three dimensions of the functions, principles and implementation strategies of mathematics teaching evaluation, whether from

Table 5. Pre-service teachers' cognition matching statistics

Category	Label	Content	Category	Label
D The Functions	D1	Feedback function	18	72
of Teaching Evaluation	D2	Incentive function	7	28
	D3	Diagnostic function	15	60
	D4	Guiding function	3	12
	D5	Prediction function	0	0
	D6	Improve the function	23	92
	D7	Management function	0	0
	D8	Assessment function	0	0
	D9	Supervision function	1	4
	D10	Regulating function	0	0
	D11	Research function	1	4
	D12	Reflective function	0	0
E Principles of	E1	Developmental principle	11	44
Teaching Evaluation	E2	The principle of combining commonness and individuality	0	0
	E3	Pay attention to the principle of the nature of mathematics	0	0
	E4	Guiding principle	2	8
	E5	Principle of effectiveness	12	48
	E6	Operability principle	3	12
	E7	Principle of comprehensiveness	15	60
	E8	Student-centered principle	3	12
	E9	Highlight the key principles	0	0
	E10	The principle of independence	0	0
	E11	The principle of measurability	0	0
	E12	The principle of reflection	0	0
	E13	The principle of pluralism	19	76
	E14	Pay attention to learning attitude	3	12
	E15	Dynamic principle	1	4
	E16	Tentative principle	0	0
	E17	The principle of participation	0	0
	E18	The principle of combination of learning and application	0	0
	E19	Scientific principle	0	0
	E20	The principle of integrity	4	16

Category	Label	Content	Category	Label
	E21	Principle of objectivity	11	44
	E22	Comprehensive principle	0	0
	E23	The principle of best motivation	0	0
	E24	Attach importance to the achievement of students' core literacy in mathematics	6	24
	E25	Process principle	8	32
F The Implementation Strategies of Teaching Evaluation	F1	Evaluation reflects the teaching goal.	0	0
	F2	Pay attention to mathematical thinking method	0	0
	F3	Mobilize students' mathematical thinking	0	0
	F4	Pay attention to the use of mathematical language	0	0
	F5	Pay attention to the main participation of students	10	40
	F6	Respect for differences	0	0
	F7	Focus on classroom teaching effect	0	0
	F8	Facing the whole	0	0
	F9	Focus on the learning process	7	28
	F10	Leave space for students to think	0	0
	F11	Focus on the application of knowledge	0	0
	F12	Focus on the all-round development of students	10	40
	F13	Reflect the characteristics of mathematics	0	0
	F14	Teaching strategies and methods	0	0
	F15	Focus on students' core literacy	4	16
	F16	Emphasize the professional growth of teachers and harmony between teachers and students.	0	0
	F17	Emphasis on teacher-student interaction	0	0
	F18	Pay attention to teaching by learning	0	0
	F19	Multiple evaluation subjects	5	20
	F20	There are various forms of evaluation.	6	24
	F21	Focus on the learning process and the evaluation of learning ability	0	0
	F22	Combining process evaluation with result evaluation.	0	0
	F23	The formulation of evaluation plan should strive to be simple and easy to operate.	0	0
	F24	The evaluation process should strive for dynamic development.	0	0
	F25	The combination of qualitative evaluation and quantitative evaluation	0	0
	F26	The evaluation criteria meet the evaluation objectives.	10	40
	F27	Conform to the law of teaching	0	0
	F28	Embody personality	7	28
	F29	Guide students to participate in the evaluation	0	0

Category	Label	Content	Category	Label
	F30	Pay attention to students' classroom performance	0	0
	F31	Scientific evaluation	0	0
	F32	Evaluation of education	0	0
	F33	Feedback adjustment should be timely	13	52
	F34	The objectivity of evaluation criteria	4	16
	F35	The flexibility of evaluation criteria	0	0
	F36	Conduct a comprehensive evaluation	10	40
	F37	Create appropriate evaluation opportunities	0	0

the overall and individual level, the cognition of pre-service teachers is not comprehensive enough, and there is a certain gap with the content of previous studies. On the whole, pre-service teachers' understanding of teaching evaluation is mostly focused on the content common to all disciplines, and their understanding lacks the disciplinary characteristics of mathematics. This point coincides with previous studies. Cao YM pointed out that the current mathematics classroom teaching evaluation standards mainly follow the classroom teaching evaluation standards of pan-disciplinary subjects, and are relatively lacking in the characteristics of the subject. The evaluation does not start from the need of promoting students' understanding of mathematics and master mathematics but only stays in the surface form [27].

5.3 Rationality of Cognition

From the above data analysis, it can be seen that in the three dimensions of the functions, principles and implementation strategies of mathematics teaching evaluation, the pre-service teachers' understanding is relatively reasonable, and the matching degree with the previous research content is high. However, there are still some contents in their cognition that have not been involved in previous studies, and the effectiveness and feasibility of these contents have yet to be verified. Similar conclusions have been made in previous studies. Sun Y pointed out that some teachers still have unreasonable evaluation phenomena such as single use of evaluation methods, lack of pertinence, and excessive emphasis on "knowledge-based" when conducting teaching evaluation [28].

6. CONCLUSIONS AND RECOMMENDATIONS

Through the investigation and analysis of cognitive situation of 25 high school mathematics pre-service teachers on the teaching evaluation under the *Curriculum Standards (2017 Edition)* this study finds the following problems: 1. Pre-service teachers' cognition of high school mathematics teaching evaluation as a whole focus on some general contents of teaching evaluation of all disciplines, and has less cognition of the content with the characteristics of mathematics [26-30]. 2. No matter from the overall or individual dimension, pre-service teachers' cognition of the functions, principles and implementation strategies of teaching evaluation is not comprehensive enough, and there is a big gap with the previous research [31-32]. 3. The pre-service teachers' understanding of teaching evaluation is highly matched with the previous research, and the understanding is reasonable, but there is still a certain one-sidedness in their cognition, and the feasibility and effectiveness of some views need to be verified [33-34].

Based on the above conclusions, the following suggestions are put forward: 1. In terms of the cultivation of pre-service teachers, relevant teachers and experts should provide more off-campus internship opportunities for pre-service teachers. Pre-service teachers should truly carry out teaching evaluation in middle schools, verify the effectiveness and feasibility of their own ideas in practice, and constantly reflect, adjust and improve, so as to enhance the cognition of teaching evaluation ; 2. Pre-service teachers themselves should take the initiative to study and research, learn the relevant evaluation methods and latest evaluation theories by treat the relevant courses of teaching evaluation seriously and reviewing literature, and try to combine the evaluation methods with the relevant contents of high school mathematics, so as to consciously carry out targeted and mathematical evaluation in the future.

The research object of this survey is 25 pre-service teachers of the same grade in the same college. The number of samples is small and the sample range is narrow, and it does not involve other pre-service teachers. Therefore, the research of this paper needs to further expand the sample range, conduct more in-depth research on the teaching evaluation of pre-service teachers, and use a variety of research methods in order to obtain more comprehensive and detailed results.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

CONSENT

As per international standards or university standards, respondents' written consent has been collected and preserved by the author(s).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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