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Research on Improvement Strategies for Junior High School Mathematics Teaching Based on Student Feedback

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Abstract: *Student feedback plays a crucial role in optimizing teaching content and improving students' mathematical learning outcomes. This study takes a middle school in Laibin City as an example, and combines teacher interviews, student questionnaires, and interview data to explore strategies for improving middle school mathematics teaching based on student feedback and put them into practice. The results indicate that incorporating student feedback into the teaching improvement system can effectively optimize teaching design and classroom interaction, ultimately having a positive impact on improving teaching quality. This article first introduces relevant teaching concepts, and then based on interviews with mathematics teachers, student questionnaires, and interview data from a middle school in Laibin City, explores strategies for improving middle school mathematics teaching based on student feedback, and conducts teaching practice. The results indicate that in middle school mathematics classroom teaching, teaching improvement based on student feedback is feasible and can effectively enhance teaching quality.*

Keywords: *student feedback; Promote teaching through evaluation; The subject status of students; Junior high school mathematics; Teaching Strategy*

1. Preface

The new curriculum reform requires teachers to take the student-centered concept as a guide for action[1], achieve role transformation through "evaluation to promote teaching", adjust teaching content and methods based on student feedback dynamics, and promote students' comprehensive development.

The research on teaching feedback at home and abroad has gone through stages of evolution: from Dewey's reflective feedback theory abroad, to Vygotsky's "zone of proximal development" promotion of differentiated practices, to Black and others verifying the promoting effect of formative feedback on learning outcomes [2-4]; Domestic research has gradually shifted from Zhang Dianzhou's (1996) establishment of feedback value to Gu Lingyuan's implementation of the "action education" model feedback mechanism, towards student-centered feedback and process evaluation [5-6]. The existing consensus emphasizes the teaching improvement function of feedback, but there is still a gap in empirical research on middle school mathematics - it focuses more on theoretical exploration and lacks actionable strategies based on student perspectives.

Student feedback is an important component of teaching evaluation, and its immediacy and motivation [7] constitute the key basis for teaching improvement.

The theoretical value of this study is to construct a "teacher-student two-way feedback" framework, which promotes the shift of mathematics teaching from experience driven to feedback driven; The practical value is reflected in:

Firstly, teaching optimization: adjusting teaching plans through feedback to help students master core mathematical literacy;

Secondly, precise teaching. Identify the needs of students with learning difficulties, implement differentiated teaching, and ensure that no student falls behind.

Thirdly, teacher development. Provide practical reference for new teachers and bridge the gap between theory and practice.

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2. Research Paths

In response to the difficulty of middle school mathematics teaching and the cognitive characteristics of students, this study takes a middle school in Laibin City as a sample, collects relevant data through questionnaire surveys, question interviews, etc., analyzes from the aspects of teacher teaching, teaching methods, teaching content, classroom atmosphere, learning effects, etc., and explores improvement strategies for middle school mathematics teaching based on student feedback.

2.1 Investigation and Analysis at the Teacher Level

The school's mathematics teacher team is mainly composed of experienced teachers, with a relatively low proportion of newly hired teachers. By conducting in-depth interviews with the teaching staff, we aim to explore their views and implementation of using student feedback to optimize teaching, providing practical basis for future research.

2.1.1 Analysis of Teacher Interview Results

On the premise of ensuring that the number of teachers participating in the interview for each grade is basically equal, we randomly selected 9 mathematics teachers from the middle school for the interview. The interview topics cover dimensions such as teachers' emphasis on student feedback, handling negative evaluations, and optimizing classroom interaction through feedback. The problem is as follows:

Question 1: Do you value students' feedback during the teaching process? Why?

Question 2: Have you ever encountered a situation where students have made negative evaluations of teaching? How do you usually handle it?

Question 3: How would you use student feedback to optimize the interactive atmosphere or enhance student engagement in the classroom?

Question 4: What is the biggest difficulty you encountered in using student feedback for teaching improvement?

Question 5: Have you identified any blind spots or deficiencies in your teaching through student feedback? How does this inspire your career development?

The interview results showed that the interviewees attached great importance to student feedback, stating that students are the main body of the classroom and teaching is a two-way process. Not only do teachers need to impart knowledge, but students also need to absorb and understand it. Student feedback can help teachers understand students' understanding of teaching content, their acceptance of teachers' teaching methods, as well as the difficulties and needs they encounter in the learning process. Teachers adjust their teaching strategies accordingly, increase students' sense of participation, and make teaching more effective. At the same time, through student feedback, teachers have gained a clearer understanding of their teaching problems and provided direction for future teaching improvement.

2.2 Student level investigation and analysis

The investigation at the student level is divided into two stages. The first stage is a questionnaire survey aimed at understanding students' learning characteristics and basic situations, providing a basis for setting teaching goals and optimizing teaching methods. The second stage is to randomly select a certain proportion of students for interview and communication in the later stage of the research. Through teaching practice based on student feedback, I have personally experienced the teaching changes based on student feedback. Through this interview, we aim to understand students' classroom experiences and feelings towards teaching improvements based on student feedback, as well as whether these improvements have had a positive impact on students' learning. At the same time, it also examines teaching issues from the perspective of students, providing new ideas and directions for teachers' mathematics teaching. After careful screening, 100 questionnaires were distributed to each of the three grades, and a total of 300 questionnaires were distributed and collected. The validity rate of the questionnaires reached 100%.

2.2.1 Student Perspectives on Teacher Teaching

This study investigated students' opinions on teachers' teaching attitudes, teaching explanations, teaching blackboard writing, and the strength of teaching targeting. The results are shown in Table 1 . A

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survey shows that students have a high recognition of teachers' professional attitude, with a satisfaction rate of 84.33% with their teaching attitude. They generally believe that teachers have solid teaching foundation abilities, with 87% positive evaluations for blackboard design, 74.34% effectiveness in explaining example problems, and 82.33% targeted problem-solving rate. But there are also some students who have given negative feedback. The teacher's explanation of the example questions is mostly effective, but there are a small number of students who need more help and may need to pay attention to their needs. And it is also necessary to pay attention to increasing interaction with students who are not actively engaged in class, so that they feel noticed and improve their enthusiasm for learning mathematics.

Table 1: Students' Views on Teachers' Teaching

Name	Options	Proportion (%)
Are you satisfied with the teaching attitude of your math teacher?	Satisfied	84.33
	General	14.67
	Unsatisfied.	1.00
Do you think the math teacher is clear and easy to understand when explaining examples?	Very clear, easy to understand.	27.67
	Comparatively clear, basically understandable.	46.67
	Generally, one needs to think it over by oneself.	2.33
	Not clear, difficult to understand	3.33
Do you think the chalkboard writing of the math teacher in class is clear and well-organized?	Very clear and well-organized	39.67
	Comparatively clear and well-organized.	47.33
	Average, not very clear	2.00
	Not clear, lacks organization.	2.00
Did the math teacher encourage you to ask questions and express your own opinions in class?	Frequent encouragement, positive response	36.33
	Sometimes encouragement, will respond	45.00
	Occasional encouragement, with less response.	15.00
	Rarely encouraged, essentially no response.	3.67
Do you think the teacher's questions in class are targeted at the students?	Highly targeted, capable of solving problems	33.00
	Comparatively targeted, most can be resolved	49.33
	Generally, some questions are not very relevant.	11.00
	Not very targeted, cannot solve the problem	6.67

2.2.2 Students' Perspectives on Teachers' Teaching Methods and Content

This study also conducted a survey on teachers' teaching methods and content from the perspective of students, including the use of various teaching methods by teachers to assist teaching and evaluate teaching effectiveness, as well as teacher classroom guidance and organization, as shown in Table 2. A survey shows that math teachers are generally able to use multiple teaching methods in their teaching.

The learning methods, especially multimedia teaching, have a good effect, accounting for 82%. Multimedia teaching can present mathematical concepts and problem-solving processes in a more intuitive and vivid way, which has been widely recognized by students. At the same time, teachers have also achieved certain results in guiding students to summarize and generalize knowledge, as well as organizing classroom discussions. However, a small number of students are dissatisfied with the organization and quality of classroom discussions, which may be related to factors such as the choice of discussion topics, time arrangements, or student participation. Therefore, further improvement and optimization are still needed to enhance teaching effectiveness and student satisfaction.

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Table 2: Students' Opinions on Teaching Methods

Name	Options	Proportion (%)
Will the teacher use a variety of teaching methods (such as multimedia, physical teaching aids, etc.) to assist in teaching in the classroom?	Always will.	71.33
	Sometimes it will	22.33
	Rarely will	6.33
How do you evaluate the effectiveness of mathematics teachers using multimedia teaching methods (such as PPT, animations, etc.)?	The effect is quite good, it can assist in understanding.	82.33
	The effect is average, it can be either present or absent.	13.00
	The effect is not good, it's better not to use it.	4.67
Will the teacher guide you to summarize and conclude knowledge in class?	Always leads, with great effect.	31.67
	Frequently guiding, there is a certain effect.	55.00
	Sometimes guidance, the effect is unclear	9.67
	Rarely guided, essentially no effect.	3.67
Are you satisfied with the way and effectiveness of the math teacher's organization of classroom discussions?	Satisfied, the discussion has been somewhat effective.	70.33
	Generally, the discussion effect is not significant.	24.00
	Unsatisfied, discussion organization is not well done.	5.67

2.2.3 Student Perspectives on Classroom Atmosphere

The survey results of this study on learning motivation, classroom discipline, classroom atmosphere, etc. from the perspective of students are shown in Table 3. A survey shows that based on a mutually respectful teacher-student relationship, 36.67% of students reported frequent and proactive interactions with teachers in math classes, 58.67% of students believed that the overall learning enthusiasm of the class was high, and most students showed high learning enthusiasm and initiative. This indicates that these students actively ask questions, answer questions, or participate in discussions in the classroom, which helps deepen their understanding of knowledge and increase their interest in learning. This positive learning atmosphere also promotes the progress and development of all students and lays the foundation for better classroom discipline and atmosphere. But there is also room for improvement in certain aspects. For example, for students who have less interaction or low motivation, teachers can help them overcome obstacles through personalized guidance and support; Meanwhile, maintaining good classroom discipline and creating an open and friendly learning environment are also important factors in improving teaching quality.

Table 3: Students' Perceptions of Classroom Atmosphere

Name	Options	Proportion (%)
How is your interaction with the teacher in math class?	Frequently interacts and is relatively proactive	36.67
	Occasionally interacts, not very proactive	42.33
	Rare interaction, passive participation	14.00
	There is almost no interaction.	7.00
How do you think about the enthusiasm for learning in the math class among the classmates in your class?	High enthusiasm, most initiative	58.67
	The enthusiasm is average, some students are proactive	31.67
	Low enthusiasm, only a few students take the initiative	9.66
How do you think about the discipline in the mathematics classroom?	Discipline is good, and they can basically listen attentively.	83.00
	The discipline is generally acceptable, but there are individual students who violate the rules.	16.00

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	Poor discipline, with frequent talking among individuals.	1.00
How is the relationship between teachers and students in the classroom?	Good relationship, mutual respect	84.67
	The relationship is average, just a teacher-student relationship.	14.00
	The relationship is not very good, there is a sense of distance.	1.33
Do you think the atmosphere in the math classroom is relaxed and pleasant?	Easy and pleasant	66.33
	General	29.67
	Not easy and pleasant	4.00

2.2.4 Student Perspectives on Learning Effectiveness

The survey results of this study on classroom performance, knowledge mastery, mathematical thinking ability cultivation, learning interest, and other aspects from the perspective of students are shown in Table 4. A survey shows that 44.00% of students are satisfied with their math classroom performance, 43.00% of students believe they have mastered math well, 83.00% of students believe that math classroom teaching is helpful in cultivating their math thinking ability, and 65.33% of students are interested in math and willing to learn it. This indicates that mathematics classrooms can stimulate students' interest and enthusiasm for learning. These students' participation, understanding ability, and learning outcomes in the classroom have met their expectations, and they can better understand and apply the knowledge they have learned. Moreover, classroom teaching has achieved good results in cultivating students' logical thinking, problem-solving ability, and other aspects. However, nearly half of the students still feel that their performance in math class is average or unsatisfactory, and that their knowledge mastery is also average. This may mean that they still have room for improvement in certain aspects and need more encouragement and support to enhance their confidence and enthusiasm. There are difficulties in certain knowledge points and more practice and review are needed to consolidate their knowledge. Teachers can further improve students' learning outcomes and satisfaction through personalized teaching, increased interaction and practical activities, and optimized teaching methods.

Table 4: Students' Views on the Effectiveness of Learning

Name	Options	Proportion (%)
Are you satisfied with your performance in math class?	Satisfied	44.00
	General	46.00
	Unsatisfied.	10.00
How well do you grasp mathematical knowledge through mathematics classes?	Have a better grasp	43.00
	Master the general	47.33
	Not well grasp	9.67
Do you think that mathematics classroom teaching is helpful in cultivating your mathematical thinking ability?	Helpful, thinking ability has improved.	83.00
	The help is not significant, the feeling is not noticeable.	14.67
	No help.	2.33
How interested are you in the subject of mathematics?	I am quite interested and willing to learn mathematics.	65.33
	Interest is average, not particularly like or dislike.	28.67
	Not very interested, find mathematics very boring	6.00

2.2.5 Analysis of Student Survey and Interview Results

Based on the questionnaire survey, we further expanded and extended the questions in the questionnaire. After implementing improvements in middle school mathematics teaching based on student feedback, interviews were conducted with students regarding the following issues.

Regarding interview questions:

Question 1: What changes have teachers made in their teaching attitude?

Question 2: Will teachers now use different teaching methods to teach different types of

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mathematics content? Which teaching method do you prefer?

Question 3: Will the teacher now guide you to apply mathematical knowledge to practical life?

Question 4: What do you think of the current classroom atmosphere? Do students dare to ask questions and express their ideas?

Question 5: What changes have you made in your current attitude towards learning mathematics? Has the learning effect improved?

The survey and interview results show that compared to the previous questionnaire survey, students' learning enthusiasm is not high. Now there has been a good change, more students are willing to ask questions and express their ideas, more actively participate in the classroom, and the classroom atmosphere and teacher-student relationship are also improving compared to before. The attitude towards learning mathematics is developing positively, and we believe that through continuous teaching improvement, students will enjoy learning mathematics more and be able to achieve better learning outcomes. Proving that teaching improvement based on student feedback has certain practical value.

3. Analysis of research results

This study collected academic performance data of the experimental group and the control group at the beginning and end of this semester; And a comparative analysis was conducted on the changes in grades of the two groups of students; The statistical results were obtained, after a period of teaching activities, the grades of both groups of students showed an upward trend; However, the improvement in performance of the experimental group (23%) was significantly higher than that of the control group (14%); This discovery further confirms the practical significance and application value of teaching improvement strategies based on student feedback.

4. Teaching Strategies

Based on the survey results, the following teaching strategies are provided for teachers to choose and implement independently.

(1) Teaching strategy for situational creation: By creating situational problems that are closely integrated with knowledge, teachers can guide students to engage in exploratory learning, deep thinking, and collaborative communication, thereby cultivating their innovative thinking and problem-solving abilities.

(2) Autonomous inquiry based teaching strategy: Students' cognitive development is achieved through interaction with their surrounding environment, and they continuously construct and adjust their cognitive structure through activities[8]. Teachers take students as the center, playing the role of guides and supporters, encouraging students to actively construct knowledge systems through processes such as independent exploration, problem discovery, hypothesis formulation, and verification.

(3) Interactive cooperation and communication teaching strategy: Learning is a social process. Through communication and collaboration with others, students can share knowledge, expand their thinking, improve their communication skills, and enhance their teamwork abilities.

(4) Differentiated teaching strategy: Respect students' multiple intelligences and promote their comprehensive development [9], and provide targeted teaching based on students' individual characteristics to fully unleash their potential.

(5) Problem oriented teaching strategy: Problems are the starting point and driving force of learning. Teachers should motivate students to analyze and solve problems, allowing them to construct knowledge systems and enhance their abilities through exploring problems[10]. This process can stimulate students' interest and motivation in learning, cultivate critical thinking and innovative spirit.

(6) Flipped classroom teaching strategy: The classroom should become a place for students to solve problems, communicate and cooperate, and deepen understanding. Students construct preliminary knowledge structures through self-study before class, and then deepen their understanding and application of knowledge through classroom interaction and cooperation[11].

(7) Feedback adjustment teaching strategy: Teachers adjust teaching content, methods, progress,

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and evaluation methods in a timely manner based on students' learning feedback (such as assignments, tests, classroom performance, etc.).

(8) Reflection and summary of teaching strategies: Reflection is an important part of the learning process. Teachers should guide students to reflect and summarize in order to deepen their understanding and application of knowledge, thereby enhancing learning outcomes[12].

5. Conclusion

This study transformed the feedback method from traditional "teacher led indirect feedback" to "immediate feedback with active student participation". This transformation not only improves the timeliness and accuracy of feedback, but also provides precise basis for teaching adjustments. This transformation not only puts the "student subject status" into practice, enhances students' participation and influence in the teaching process, but also promotes the two-way development of teachers and students' abilities: teachers optimize teaching strategies based on student feedback, improve classroom quality and professional competence, while students strengthen their learning experience through active participation. Research has shown that student feedback has become the core driving force for teaching improvement, driving education from experience driven to evidence driven, prompting teachers to adjust teaching strategies based on students' real needs and learning experiences, thereby improving teaching quality.

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