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Investigation and Analysis of the Current Situation of Junior High School Students' Use of MENBs and Optimization Strategies

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Abstract: ***This paper takes the first and second grade students of a junior high school in Anyang as the research object, using literature research method, questionnaire survey method, semi-structured interview method and statistical analysis method, from the three dimensions of cognitive attitude, behavioral habits and application strategies to investigate the use of junior high school students' math error notebooks (MENBs). The results show that there are significant differences in the use of MENBs among students with different academic levels. In actual learning, most students have insufficient cognition of error management, focusing merely on the correction of errors while ignoring in-depth analysis, lack of collection and classification of mathematical errors; teachers only release tasks, but fail to fulfill the responsibility of supervision and guidance, resulting in poor actual effect of the MENBs. Based on the survey results, this paper proposes corresponding optimization strategies from the two dimensions of students' self-management and teachers' teaching guidance. At the same time, it clarifies the standardized establishment process of MENBs, and provides reference for improving students' mathematics learning efficiency and optimizing teachers' teaching.***

Keywords: Math error notebook, Error management, Questionnaire survey, Optimization strategy.

1. Introduction

Errors refer to the general term of the questions that students make in the process of mathematics learning and problem-solving practice, covering classroom examples, after-school exercises, unit tests, comprehensive examination questions, etc., and the answers do not conform to the correct solution of the questions, the conclusion deviates from the standard answer, or there are logical loopholes, deviation of ideas, omission of steps, misuse of concepts and other problems in the process of problem-solving. It is not a simple answer to the mathematical errors. Its essence is the direct external manifestation of students' mathematical knowledge mastery loopholes, deviation of thinking mode, improper problem-solving methods, and omission of learning habits.

From the perspective of the causes of errors, mathematical errors can be divided into three categories: knowledge errors, thinking errors, and habitual errors. Knowledge errors originate from students' vague understanding, memory errors or improper application of basic knowledge such as mathematical concepts, formulas and theorems. The thinking errors are caused by the rigid thinking of students' problem solving, the lack of rigorous logical reasoning, the lack of ability to combine numbers and shapes, and the incomplete discussion of classification. Habitual errors are caused by bad learning habits such as careless examination, calculation errors, non-standard steps, and scribble. As an important resource in mathematics learning, mathematical errors can accurately reflect students' weak points in learning. It is an important basis for students to check and fill gaps, optimize thinking, teachers to carry out targeted teaching and optimize teaching strategies.

Math error notebook (MENB) is a personalized learning carrier for students to independently screen, systematically sort out, deeply analyze and reflect on all kinds of mathematical errors in the process of mathematics learning. It is the core tool to implement the management of mathematical errors. It is different from the notebook that simply extracts the mathematical errors. Its core is to consolidate knowledge and optimize thinking through combing and reflecting on errors. It is an important practical form for students to carry out autonomous learning of mathematics.

The core content of the MENB is the problems that the students make mistakes by themselves, and a complete content system is formed around the mathematical errors, including the presentation of the original questions, the record of the mathematical errors solving process, the writing of the correct ideas and steps, the analysis of the causes of the errors, the labeling of the related knowledge points, the reflection and the supplement of the similar variant exercises, and then the learning closed loop of "recording the mathematical errors--analyzing the wrong cause--combing the knowledge — application" is constructed. It can not only help students to accurately locate the weak points of mathematical knowledge, gradually correct the thinking deviation and method misunderstanding in problem solving, and cultivate good habits of mathematical reflection, but also provide teachers with real learning basis for grasping students' personalized learning situation, carrying out targeted error teaching and stratified guidance. It has become an important link between students' autonomous learning and teachers' precise teaching, and plays a dual value in improving students' learning efficiency and optimizing mathematics teaching practice.

This paper takes the first and second grade students of a junior high school in Anyang as the research object, and focuses on the systematic investigation and analysis of the current situation of the use of MENBs. The core objectives are as follows:

1) Through the questionnaire survey of junior high school students, the differences in the use of MENBs among students of different grades and different academic levels are

compared to understand the actual situation of students' cognition and attitude, behavior and habits, and application strategies in error management.

2) Through interviews with junior high school mathematics teachers, we can understand teachers' attitudes and strategies towards mathematical error management, and how to guide students to carry out error management efficiently and how to make use of the resource of errors. At the same time, interviews are conducted with students of different academic levels to truly understand the actual situation of students' use of MENBs;

3) To sort out the main problems and actual needs of students in the use of MENBs, and analyze the key factors that affect students' efficient use of MENBs;

4) Combined with the school's learning situation, an optimization strategy that can be implemented is proposed to provide a basis for teachers to optimize the management of mathematical errors and improve students' ability to sort out and use mathematical errors.

This paper will focus on the three modules of current situation investigation, problem analysis and strategy construction, and carry out progressive research.

In the current situation investigation module, a combination of questionnaire survey and semi-structured interviews between teachers and students is adopted. Two parallel classes of junior high school students are selected by cluster sampling method to carry out questionnaire survey, and quantitative data are collected from three dimensions: cognition and attitude, behavior and habits, and application strategies. Students with different academic levels and mathematics teachers are selected to conduct interviews to supplement the deep information that the questionnaire could not present, and to fully restore the real situation of the use of MENBs.

The problem analysis module, based on the questionnaire and interview results, analyzes the current situation of junior high school students' use of MENBs from three dimensions: cognition and attitude, behavior and habits, and application strategies. At the same time, combined with students' cognitive habits, teachers' guidance and supervision, and the adaptability of stratified teaching, this paper analyzes the current situation of junior high school mathematics error management, digs out the existing problems, and deeply explores the causes behind them.

The core of the strategy construction module is to closely follow the school's learning situation and teaching practice. From the aspects of establishing scientific error management concepts, standardizing behavior and habits, optimizing application strategies, and integrating daily teaching, a hierarchical and classified MENB use optimization system is constructed to help students standardize the use of MENBs.

In this paper, the theoretical basis of the above research, one may see [1-8].

2. Investigation and Analysis

2.1 The Design and Implementation of Questionnaire Survey

2.1.1 Objects of investigation

The research object is the first and second grade students of a junior high school in Anyang City. Using the cluster sampling method, two parallel classes of students are selected to carry out the survey. A total of 207 students were surveyed. Among them, 99 are male and 108 are female; the students' mathematics learning foundation, learning ability and other learning conditions in the class are basically the same. The samples are balanced and representative, which can objectively reflect the overall use of the MENBs of the first and second grade students in the school.

2.1.2 Questionnaire design

Table 1: Description of each dimension in the questionnaire

Dimensions	Subdimensions	Title number	Description
The cognition and attitude of the use of MENBs	Cognition of the value of MENBs	1, 2, 3	To explore the students' cognition of the value of the MENBs, the subjective attitude towards the mathematical errors and error management, to clarify the core tendency of the students at the ideological level, and to provide the root basis of the cognitive level for the subsequent problem analysis.
	Attitude of the error management	4, 5	
	Willingness to learn	6, 7	
The behavior and habits of the use of MENBs	The behavior of collecting mathematical errors	8, 9	It is the core dimension of the current situation investigation to systematically collect the specific behavior of students in the collection, collation, analysis and review of mathematical errors, quantify the key indicators such as frequency of use, content composition and review methods, and construct the behavior portrait of students' use of mathematical errors.
	The behavior of sorting out mathematical errors	10, 11	
	The behavior of mathematical error analysis	12, 13, 14	
The application strategies of the use of MENBs	The strategies of mathematical errors screening	15, 16	Dig deep into the scientific application strategies of students in the use of MENBs, analyze the methods and abilities of students in error screening, classification, review, variant consolidation, etc., clarify the strategy level and optimization space of students' use of MENBs, and provide targeted basis for subsequent optimization guidance.
	The strategies of mathematical errors classification	17	
	The strategies of mathematical errors review	18, 19	
	The strategies of mathematical errors consolidation	20	

The compilation of the questionnaire <Questionnaire on the current situation of the use of MENBs by students in a junior high school in Anyang> is mainly based on the <Questionnaire on the management strategies of junior high school students' mathematical errors> compiled by Liu Rude et al. [9], the <Questionnaire on the management of junior high school students' mathematical errors> compiled by Sun Guizhen [10] and the <Questionnaire on the management of

mathematical errors in high school students' mathematics learning> compiled by Zhou Wan [11]. This questionnaire first clarifies the basic characteristics of the research object, and provides a classification basis for the subsequent difference analysis, such as the influence of grade and academic level on the use of MENBs, so as to ensure the pertinence and comparability of the data. Then, according to the object and purpose of this study, combined with the teaching characteristics of the school, the dimension of the questionnaire survey is divided into the cognition and attitude, behavior and habits, and application strategies of the use of MENBs. Each dimension is progressive, forming a complete research logic of 'basic information positioning→ cognitive attitude paving → core behavior focusing → application strategies deep excavation → open suggestion supplement'. It not only ensures the systematicness and comprehensiveness of the data, but also accurately captures the core characteristics, problems and needs of the use of a junior high school student's MENBs in Anyang City, and provides solid data support for subsequent problem analysis and strategy construction. The description of each dimension is shown in Table 1.

The questions of this questionnaire are divided into three major items. The first major item is single-choice or multi-choice questions to understand the relevant situation of students' sorting out mathematical errors and the use of MENBs. The second major item contains three parts, using the form of Likert five-point scale: completely agree, relatively agree, general, relatively disagree, completely disagree. The third major item is open questions, to understand the students' own shortcomings in the use of MENBs and to optimize the use of MENBs.

2.1.3 Questionnaire survey process

A total of 207 questionnaires were distributed and 207 were recovered, with a recovery rate of 100 %. Data screening was carried out immediately after recovery, and invalid questionnaires that were incomplete and randomly answered were eliminated. Finally, 199 valid questionnaires were obtained, with an effective rate of 96.12 %.

2.1.4 Reliability and validity analysis of the questionnaire

Reliability test is the core statistical method to test the reliability of measurement tools such as questionnaires and scales in quantitative research. The essence is to test the consistency, stability and repeatability of measurement results. The second major item of this questionnaire consists of three parts, a total of 20 questions, and these 20 questions are scored using a five-point scoring method. After the test, Excel software was used to input and organize the results of the questionnaire. Finally, SPSS software was used to analyze the reliability and validity of the data. The results are shown in Table 2 and Table 3.

Table 2: Reliability test table

Cronbach's alpha coefficient	The number of terms
0.887	20

It can be seen from Table 2 that the Cronbach's alpha coefficient of the questionnaire is 0.887 > 0.7, indicating that the data is highly reliable, so it can stably reflect the real situation of students' use of MENBs.

Validity is the core index to test the validity and accuracy of measurement tools in quantitative research. The essence is to judge whether the measurement tools can accurately and truly measure the core concepts or dimensions that the research wants to explore, that is, to test whether the questionnaire measures the content that the research wants and the accuracy of the measurement.

Table 3: Validity test table

	KMO	Approximate chi-square	df	Sig.
value	0.829	1796.328	190	0.000
conclusion	qualification			

It can be seen from Table 3 that the KMO value of the questionnaire is 0.829, and its significance P (sig. value) is 0.000, so it can be concluded that the validity of the questionnaire is good.

2.2 Analysis of the Results of the Questionnaire Survey

In order to fully understand the relevant situation of students' MENBs, the questionnaire was designed with 20 questions, which were mainly divided into three dimensions. They are the cognition and attitude, behavior and habits, and application strategies used in the MENB. The three dimensions are designed with 7,7 and 6 questions respectively. The following will analyze the questionnaire survey data from these three dimensions.

The first part, namely, the cognitive attitude survey results of the use of MENB are shown in table 4:

Table 4: Cognitive attitude survey results

Questions	Completely agree	Relatively agree	General	Relatively disagree	Completely disagree
1.I think the MENB is conducive to improving math scores.	36 (18.09%)	60 (30.15%)	67 (33.67%)	26 (13.07%)	10 (5.03%)
2.Mathematical errors can accurately reflect my mastery of knowledge points.	24 (12.06%)	35 (17.59%)	92 (46.23%)	36 (18.09%)	12 (6.03%)
3.I think the initiative to sort out the mathematical errors is an important part of mathematics learning.	37 (18.59%)	44 (22.11%)	52 (26.13%)	50 (25.13%)	16 (8.04%)
4.I am willing to learn the scientific use of the MENB.	33 (16.58%)	53 (26.63%)	66 (33.17%)	42 (21.11%)	5 (2.51%)
5.I think taking time to sort out the mathematical errors is more valuable than doing new questions.	39 (19.60%)	42 (21.11%)	49 (24.62%)	51 (25.63%)	18 (9.05%)
6.I think not sorting out the mathematical errors in time will lead to the recurrence of similar errors.	97 (48.74%)	59 (29.65%)	28 (14.07%)	4 (2.01%)	11 (5.53%)
7.I will take the initiative to read the mathematical errors regularly to consolidate the weak knowledge points.	22 (11.06%)	41 (20.60%)	68 (34.17%)	53 (26.63%)	15 (7.54%)

From the statistical results of the first question, it can be seen that 18.09 % of the students choose to completely agree, 30.15 % of the students agree that the MENB is conducive to improving mathematics performance, a total of 48.24 % of the students agree that the MENB has a positive effect on improving mathematics performance, 33.67 % of the students hold a general attitude, and only 18.10 % of the students hold a negative attitude. This shows that most students are able to realize the positive value of the MENB to mathematics learning, and have positive expectations for using the MENB to improve their performance. However, nearly one-third of the students still have a vague attitude and lack intuitive feelings and deep recognition of the actual role of the MENB.

From the statistical results of the second question, it can be seen that only 12.06 % of the students choose to completely agree, 17.59 % of the students agree that mathematical errors can accurately reflect the loopholes in their knowledge points, 46.23 % of the students have a general attitude, and 24.12 % of the students have a negative attitude. This reflects that most students have not established the core cognition of “mathematical errors are weak points of knowledge” so far, and have insufficient understanding of the essence of mathematical errors, failing to effectively associate mathematical errors with their own knowledge loopholes, and paying more attention to the right and mathematical errors themselves in learning, while ignoring the reflection on the knowledge behind the mathematical errors.

From the statistical results of the third question, 18.59 % of the students choose to completely agree, 22.11 % of the students agree that actively sorting out the mathematical errors is an important part of mathematics learning, a total of 40.70 %, 26.13 % of the students have a general attitude, and 33.17 % of the students have a negative attitude. This shows that less than half of the students really recognize the necessity of actively sorting out the mathematical errors. More than half of the students do not pay enough attention to sorting out the mathematical errors, lack the awareness of actively managing the mathematical errors, and are more inclined to complete routine homework and exercises in learning.

From the statistical results of the fourth question, it can be seen that 16.58 % of the students choose to completely agree, 26.63 % of the students are more willing to learn the scientific method of using the MENB, 33.17 % of the students have a general attitude, and 23.62 % of the students are not willing. This reflects that nearly half of the students have the idea of learning science to use the MENB method, but more than half of the students still have a negative or neutral attitude, and lack the internal motivation to actively improve the wrong question management ability, which requires teachers to give more specific and more operational method guidance.

From the statistical results of the fifth question, it can be seen that 19.60 % of the students choose to completely agree, 21.11 % of the students agree that the learning value of sorting out the mathematical errors is higher than that of doing new questions, 40.71 % in total, 24.62 % of the students have a general attitude, and 34.68 % of the students have a negative attitude. This shows that most students are more likely to recognize the learning method of ‘doing new questions’, the value recognition of the review of mathematical errors is low, and they are more likely to refresh the questions in the allocation of learning time, rather than re-arranging the mathematical errors. It reflects that students’ learning habits still remain at the level of shallow brushing questions and lack the awareness of deep reflection and consolidation.

From the statistical results of the sixth question, 48.74 % of the students completely agree, 29.65 % of the students agree that not sorting out the mathematical errors in time will lead to the recurrence of similar errors, accounting for 78.39 % of the total. This shows that the vast majority of students can clearly realize the harm of delaying the collation of the mathematical errors, and have a basic risk perception of the importance of the management of the mathematical errors, which is an important cognitive basis for guiding students to sort out the mathematical errors actively and timely.

From the statistical results of question 7, it can be seen that 31.66 % of the students have the habit of actively reviewing the mathematical errors on a regular basis, 34.17 % of the students have a general attitude, and 34.17 % of the students have a negative attitude. This shows that most students lack the consciousness of normal review of mathematical errors. Even if they have completed the arrangement of mathematical errors, they have not been able to review and consolidate regularly. The mathematical errors only stay at the record level, failing to play the core role of circular review and leak filling. Teachers need to guide students to establish a fixed rhythm of review of mathematical errors.

From the above questionnaire results, students generally realize that not sorting out the mathematical errors in time will lead to repeated errors, but the value recognition of the mathematical errors, the awareness of active sorting, and the habit of regular review are still weak as a whole. There are obvious deficiencies at the cognitive level, and teachers need to strengthen guidance and method guidance.

The second part is about the behavioral habits used in MENBs. The survey results are shown in Figure 1 - Figure 7:

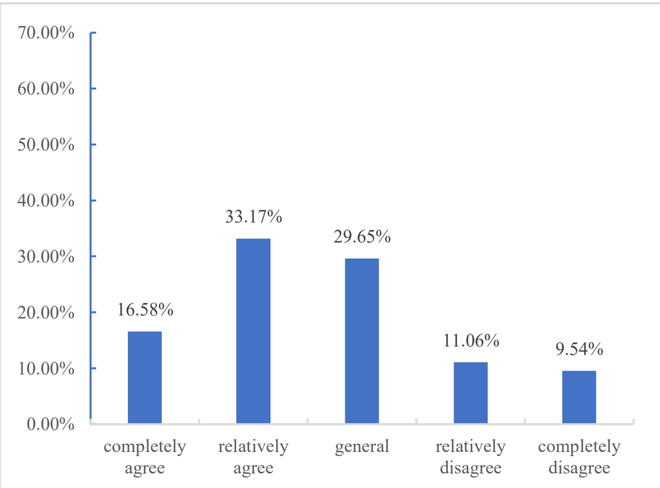

Figure 1: There are special MENBs for sorting out all kinds of mathematical errors.

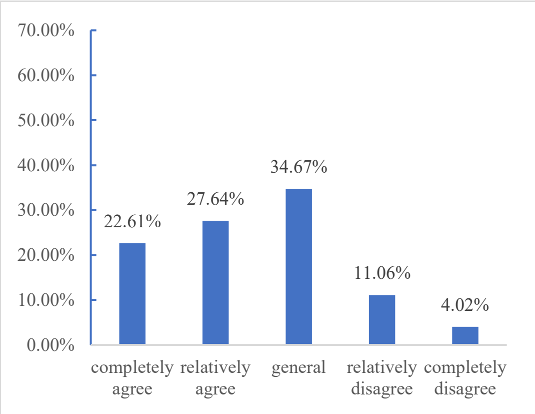

Figure 2: After the occurrence of mathematical errors, it will be sorted into the MENB in time.

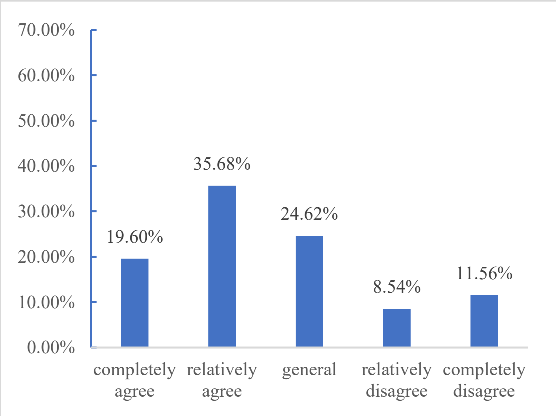

Figure 3: Will be fixed time to focus on sorting out and combing the recent mathematical errors.

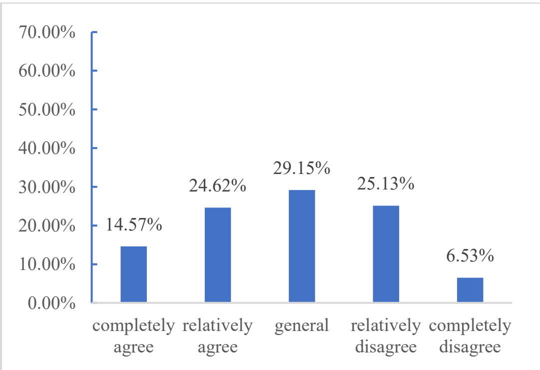

Figure 4: When sorting out the mathematical errors, you will carefully write a complete correct answer process.

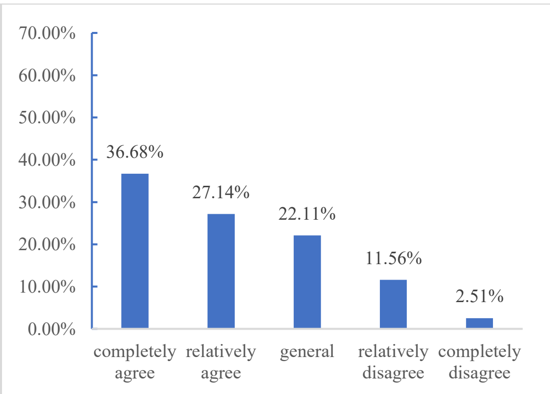

Figure 5: When you encounter problems that cannot be solved independently, you will take the initiative to ask your teacher or classmates for advice.

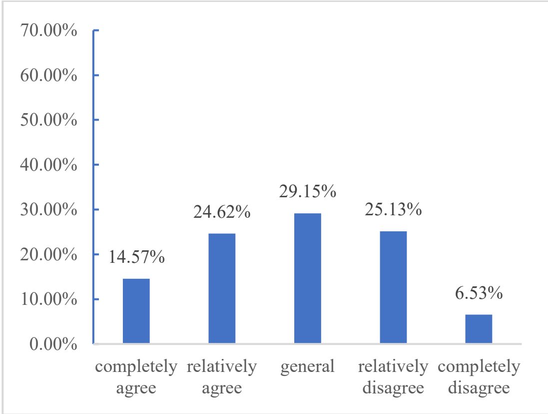

Figure 6: When sorting out the mathematical errors, you will reflect on the cause of the error.

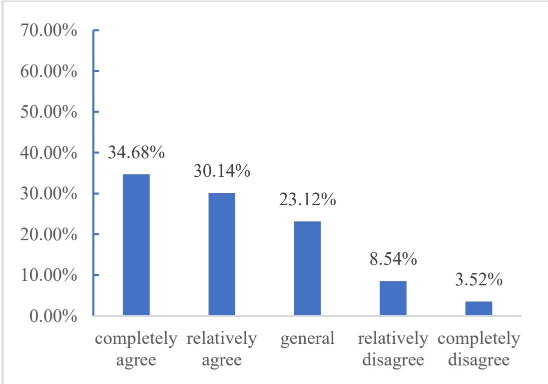

Figure 7: When sorting out the mathematical errors, the mathematical knowledge points corresponding to the mathematical errors will be actively marked.

Question 8 focuses on whether students are equipped with a special MENB. The data show that a total of 49.75 % of students have prepared a special book for the arrangement of mathematical errors. This part of the students has the basic conditions for the arrangement of mathematical errors; however, 29.65 % of the students still have a vague attitude on this issue, and even 20.60 % of the students have no special MENB. This result shows that nearly half of the students attach importance to the collation of mathematical errors and prepare a supporting book for them, while more than half of the students do not have a dedicated MENB or do not care about this problem, which will directly affect the standardization and continuity of the collation of mathematical errors.

The focus of question 9 is whether students can sort out the mathematical errors in time after they make mistakes. The data shows that about half of the students can deal with the mathematical errors in time. And 34.67 % of the students sort out very casually, remember to do, and 15.08 % of the students will not sort out the mathematical errors in time. This shows that most students do not develop the habit of sorting out in time, and the mathematical errors are often delayed. When they look again, they may have forgotten the wrong ideas at that time, and it is difficult to solve the problem fundamentally.

Question 10 investigates whether students will focus on sorting out the mathematical errors in fixed time. The results show that 19.60 % of the students insist on sorting out the mathematical errors in fixed time every week, 35.68 % of the students will basically sort out the mathematical errors regularly, and more than 50 % of the students have the habit of sorting out the mathematical errors regularly. 24.62 % of the students have no fixed time, all by mood arrangement, and 20.10 % of the students never fixed time finishing. It can be seen that some students can manage the mathematical errors in a planned way, but there are still many students who organize the mathematical errors by temporary reminding, without their own planning, making the mathematical errors scattered and incoherent.

Question 11 Investigate whether students will write the correct problem-solving process completely when sorting out the mathematical errors, the data show that 14.57 % of the students will seriously write the whole steps, 24.62 % of the students will basically standardize the writing; and 29.15 % of the students write more perfunctory, and 31.66 % of the students only write answers, do not write the problem-solving process. This reflects that many students only deal with the mathematical errors, and only copy the answers without combing the ideas. In the follow-up review, there will be a situation where they cannot understand the logic of solving problems at all, so that the mathematical errors will lose the significance of their review.

Question 12 investigates students' attitude towards solving difficult and mathematical errors, and understands whether they take the initiative to ask for help when they encounter mathematical errors that cannot be solved independently. Among them, 63.82 % of students will take the initiative to ask teachers and classmates for help, with a positive sense of help. 22.11 % of the students were hesitant, and 14.07 % of the students chose to give up seeking help when they encountered difficulties. This result reflects that most students are willing to take the initiative to overcome difficult and mathematical errors and leave no learning problems. However, there are still a few students who are reluctant to consult due to face or lack of courage, resulting in that the mathematical errors cannot be solved in time and gradually become learning loopholes.

The 13th question focuses on whether students will take the initiative to reflect on where they are wrong when sorting out the mathematical errors. The data shows that only 14.57 % of students will seriously reflect on the cause of error, 24.62 % of students will basically reflect, and less than half of the students can think deeply about the cause of the error. The remaining students occasionally reflect or never reflect on the cause of the error. This is the most critical part of the error sorting, but it is also the worst part of the students. Most students only modify the answer without finding the root cause, so they cannot fundamentally avoid the recurrence of similar errors.

Question 14 focuses on the systematic arrangement of students' mathematical errors, and investigates whether the mathematical knowledge points corresponding to the mathematical errors will be marked. The data show that 34.68 % of the students will certainly mark the knowledge points, 30.14 % of the students will basically mark, and a total of 64.82 % of the students can correspond the mathematical errors to the knowledge points one by one; 23.12 % of the students have no labeling habits, and 12.06 % of the students do not mark the knowledge points at all. This shows that most students are more targeted to sort out the mathematical errors, which is convenient for the follow-up to fill in the gaps according to the knowledge points, but some students still ignore the knowledge points. The mathematical errors are only the stacking of questions and answers, and there is no pertinence in the review, which ultimately leads to a great reduction in learning efficiency.

In general, about half of the students can prepare the mathematical errors, sort out them in time, and sort out them regularly. They are also willing to take the initiative to consult when encountering problems, but they do poorly in the two core links of reflecting on the causes of errors and marking knowledge points. Most of the students only stay on the surface of 'copying the answers', without deep thinking and systematic combing, and fail to really play the role of filling in the gaps and improving the performance of the mathematical errors.

The third part is the application strategies of the use of MENBs. The survey results are shown in Figure 8-Figure 13:

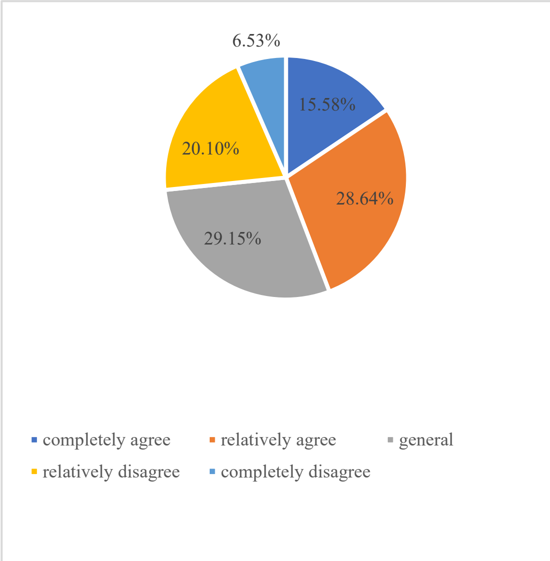

Figure 8: Prioritize recording typical and high-frequency errors mathematical errors

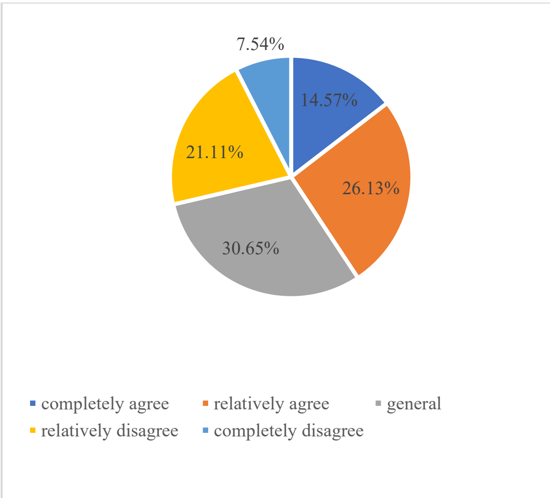

Figure 9: Classify and sort out mathematical errors

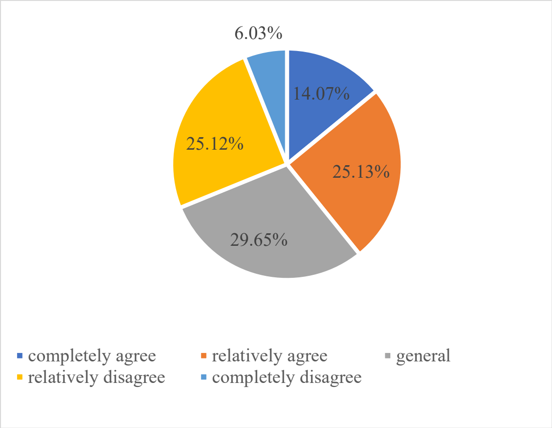

Figure 10: Carefully analyze the cause of errors

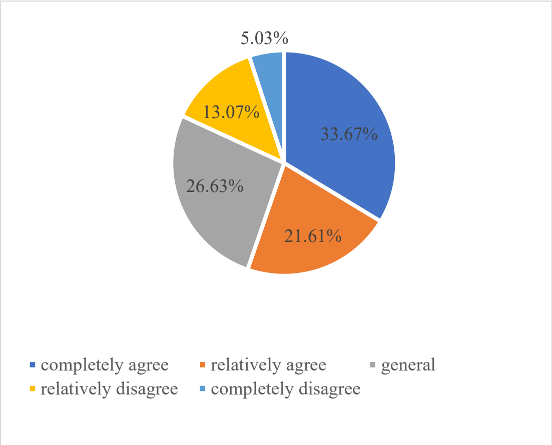

Figure 11: Targeted review before the examination

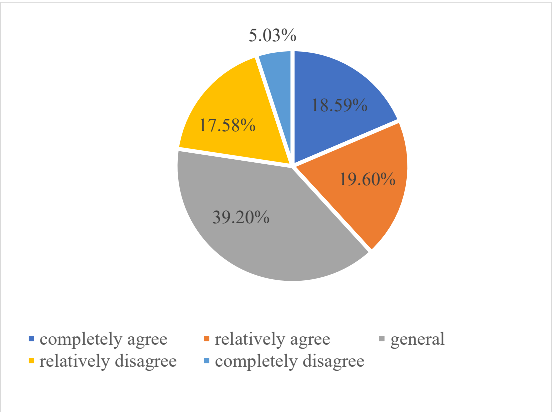

Figure 12: When reviewing, the previous mathematical errors will be done again.

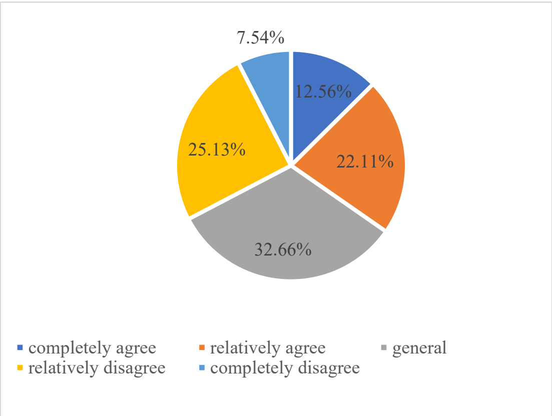

Figure 13: After correction, find similar questions to practice.

Question 15 investigates whether students will selectively sort out mathematical errors and give priority to recording typical and high-frequency mathematical errors. The data shows that 15.58 % of the students choose to completely agree, 28.64 % of the students agree relatively, and the two total 44.22 %; 29.15 % of the students have a general attitude, and 26.63 % of the students will not screen the mathematical errors. This shows that nearly half of the students have the consciousness of screening the mathematical errors and know how to prioritize the key questions, but there are still a large number of students who do not combine their own reality when sorting out the mathematical errors, blindly record all the questions, which is a waste of time and it is difficult to overcome the weak points of learning in a targeted manner.

The 16th question mainly understands whether students will classify and sort out mathematical errors according to knowledge points or question types. The results show that only 40.70% of the students can be classified, and nearly 60% of the students have not formed the habit of classification. This shows that most of the students' MENBs are only simple transcriptions of the questions, lack of organization, and it is difficult to quickly find similar problems during review, which is not conducive to systematically combing knowledge loopholes.

Question 17 investigates the implementation of students' error cause analysis. Only 39.20 % of students can carefully analyze the error cause, and more than half of the students have not implemented the core reflection link. This result is highly consistent with the research conclusion of reflecting the error cause in the dimension of behavioral habits, which proves that the error cause analysis is the weakest and most critical shortcoming in the use of junior high school students' MENBs.

Question 18 investigates whether students will review the mathematical errors before the examination or unit review. The data show that a total of 55.28 % of the students can take the initiative to use the MENB in the review, indicating that more than half of the students have realized the review value of the MENB. However, there are still some students who are more accustomed to refreshing questions and making new volumes, and do not make full use of the MENB for targeted consolidation.

Question 19 mainly investigates whether students can test their mastery by re-doing questions when reviewing the MENB. The data shows that only 38.19 % of the students can take the initiative to redo the mathematical errors, nearly 40 % of the students have a general attitude towards it, and 22.61 % of the students will not redo the mathematical errors. It can be seen that most students still focus on "browsing" when reviewing mathematical errors, lacking the habit of hands-on practice and self-testing. It is difficult to truly test whether they have thoroughly mastered relevant knowledge, resulting in a mere formality in the review of mathematical errors, and the actual effect is not ideal.

The purpose of the 20th question is to understand whether students will consolidate exercises through the same type of variant questions after correcting the mathematical errors. The results show that only 34.67 % of the students can actively complete the variant exercises, and the rest of the students do not carry out the expansion training. This shows that students generally lack the awareness of drawing inferences from one instance in the use of mathematical errors. Most of them stay in the shallow stage of the end of the revision, and fail to internalize and absorb the problem-solving methods corresponding to the mathematical errors. Therefore, in the face of similar problems, it is still easy to repeat errors.

On the whole, students are basically at the level of basic record and induction in the use of the MENB, and the habit of reviewing the mathematical errors before the exam is relatively good. In the implementation of deep learning strategies such as screening and sorting out mathematical errors, classifying and summarizing key points, analyzing the root causes of errors, redoing test results, and carrying out variant consolidation exercises, the implementation is generally low. This shows that although students have the consciousness of using the MENB, they have not yet formed a scientific, systematic and in-depth use method, and the core role of the MENB in improving the learning effect has not been fully reflected.

3. Interviews on the Establishment and Management of Junior High School Students' MENBs

3.1 Interview Questionnaire Design Ideas

On the basis of carrying out the questionnaire survey, in order to further understand the process, difficulties and internal needs of students' real use of the MENB, and to fully grasp the teachers' understanding of the teaching value of the MENB, daily guidance methods and actual use, two interview questions of student interview outline and teacher interview outline were designed.

The student interview outline [12] set up questions around the establishment process, sorting habits, frequency of use, practical difficulties and improvement expectations of the MENB. In order to fully understand the real situation of students at different levels using the MENB, one representative was selected from the top students, the junior high students and the students with learning difficulties in the first and second grades of junior high school, and a total of 6 students were selected for one-on-one interviews.

The interviewees of the teachers selected the in-service teachers of mathematics in the first and second grades of the school. The selection criteria mainly include: reasonable teaching age, rich teaching experience, long-term engagement in junior high school mathematics teaching, and familiarity with the management of students' mathematical errors. At the same time, taking into account the different teaching ages and teaching styles, to ensure that the actual practice and views of teachers in the guidance, use and evaluation of the mathematical errors are truly reflected, a total of 4 mathematics teachers were selected for interviews. The teacher interview outline focuses on the teaching value of the MENB, the necessity of carrying out the training of the MENB in the first and second stages of junior high school, the daily guidance mode of teachers, the supervision and evaluation mechanism and the teaching suggestions, etc., and conducts in-depth communication with the mathematics teachers to fully understand the real situation of the guidance and implementation of the MENB in the first-line teaching.

3.2 Interviews and Analysis of Students

From the results of the interview, it can be seen that the excellent students generally attach importance to the use of the MENB, can persist in sorting out for a long time, and have their own ideas and skills. They will selectively record typical questions and high-frequency mathematical errors, completely mark the causes and knowledge points of errors, and regularly look at them. Before the exam, the MENB will also be used as the main review material, and the use effect is obvious. Even if some students with better grades do not specifically sort out the mathematical errors, they will take the initiative to review the mathematical errors in the papers and exercises before the examination, and pay attention to the reflection and consolidation of the mathematical errors.

Some students are difficult to insist on sorting out the mathematical errors, and it is easy to give up halfway. The interview found that many junior high school students and students with learning difficulties can establish the MENB according to the teacher's requirements at the beginning, but with the increase of the amount of homework, the lack of continuous supervision, and the lack of self-consciousness, it is often difficult to adhere to it, and ultimately it is not enough. There are also students who think that sorting out mathematical errors is a waste of time and are more willing to improve their performance by doing more new questions. They do not realize the importance of reflection on mathematical errors.

The way students sort out the mathematical errors is not scientific. When many students sort out the mathematical errors, they simply copy the questions and the correct answers, do not calm down to analyze the causes of the errors, do not mark the knowledge points examined, and lack of thinking and summary. Some students do not classify, do not review, but only mechanically complete the task, resulting in poor use of the mathematical errors, can not really help themselves to make up for knowledge loopholes.

There are obvious differences in the use of MENB by students at different levels. Excellent students take the initiative, standardize and use; medium students can do but not fine, lack of persistence; students with learning difficulties are passive, unable to organize, and unwilling to persist. On the whole, although students recognize the role of the MENB, there are still obvious deficiencies in persistence, standardization and reflection.

3.3 Interviews and Analysis of Teachers

From the perspective of teachers, teachers generally highly recognize the teaching value of mathematical errors resources. They agree that mathematical errors can truly reflect students' knowledge weaknesses, thinking misunderstandings and learning habits. They are very valuable teaching resources and play an important role in checking students' omissions and improving their math scores.

Teachers said that the first grade is a critical period for the development of learning habits, and the second grade is an important stage for the differentiation of mathematics scores. Guiding students to systematically establish and use the mathematical errors as soon as possible will help to consolidate the foundation, avoid the accumulation of problems, and prevent the decline of scores.

Teachers will guide and supervise in daily teaching, uniformly require students to prepare mathematical errors, demonstrate and organize methods in class, and urge students to implement them through regular inspection and class display. However, in the actual operation, students mainly have problems such as irregular collation, copying answers without thinking, not reviewing and applying, and adhering to difficulties. Medium students can use but not fine, students with learning difficulties will not use, do not want to use; some students have resistance due to the heavy burden of copying. Teachers generally put forward that we should simplify the process of sorting out, allow the paste of cut questions, implement hierarchical requirements, strengthen the demonstration of methods, improve the supervision mechanism, so that students can change from passive completion to active use, and truly play the role of consolidating knowledge and improving ability.

4. The Optimization Strategies of MENBs Use in Junior High School Students

4.1 Establish a Scientific Concept of Error Management

4.1.1 Clarify the essence of mathematical errors and construct the important consciousness of mathematical errors

Teachers need to make students understand that mathematical errors are not ‘trouble’ in learning through classroom explanation and case sharing, but the core resources that accurately reflect their own knowledge weaknesses, thinking misunderstandings and habits loopholes, which are the most targeted points. It guides students to jump out of the shallow thinking that only focuses on the right and wrong of the question, and establishes the core cognition of ‘mathematical errors = knowledge loophole’, so that students can truly understand that the essence of sorting out mathematical errors is to make up for the shortcomings of knowledge and avoid making similar errors, rather than simply completing tasks. Teachers can use the comparative analysis of the same type of high-frequency error-prone questions in junior high school mathematics to enable students to intuitively experience the value of error sorting. For example: Error-prone question 1: Calculation $-2^2+3\times(-1)^4-4\div(-2)$; Error-prone question 2: Calculation $-3^2+2\times(-2)^3+6\div\left(-\frac{1}{2}\right)$.

This paper first analyzes the error-prone question 1, which is a typical error problem of rational number operation in the first volume of the first grade of junior high school. The core loopholes of students’ errors are that they do not master the rules of multiplier symbols and the order of operation is chaotic. The errors focus on calculating -2^2 into 4, ignoring the knowledge point that ‘minus sign does not belong to the base number of multipliers’, and confusing the priority of multiplication and division.

The correct answer: first calculate the multiplication formula $-2^2=4,(-1)^4=1$, then calculate the multiplication and division $3\times1=3$, $4\div(-2)=-2$, and finally calculate the addition and subtraction $-4+3-(-2)=1$. The error directly exposes the students’ knowledge loopholes of fuzzy concept and irregular operation steps of rational number multiplication formula, not simply careless.

Then look at the error-prone question 2, although the number and symbol of the problem have changed, the knowledge points of the multiplication symbol judgment and the mixed operation order examined are completely consistent with the error-prone question 1, and the source of the error is exactly the same. If the students do error-prone question 1, timely organize the error, mark the cause of the error, fully grasp the knowledge points of the multiplier and the order of operation, and meet the error-prone question 2 again, they can quickly avoid symbol errors, clarify the operation steps, and eliminate the same kind of points from the root.

4.1.2 Correct the misunderstanding of learning, change the inherent concept of ‘focus more on doing exercises than on reviewing’

In junior high school mathematics learning, most students fall into the misunderstanding of blindly doing questions for the pursuit of quantity. They think that the more questions they do, the faster the performance improvement, and even think that sorting out the mathematical errors is a waste of time. However, the core of junior high school mathematics is the understanding of knowledge points and the internalization of methods. The root cause of the repeated occurrence of similar errors is not that the amount of exercises is not enough, but that the knowledge loopholes behind the errors have not been filled and the question-solving ideas have not been clarified. Teachers should correct students’ wrong ideas by combining students’ daily homework and high-frequency mathematical errors in examinations, so that students can understand that blindly doing ten new questions is not better than understanding a mathematical error. The mathematical errors are the exclusive question that best suits their own learning situation. Taking the solution of unary linear equation as an example. Error-prone question 1: Solving the equation $2(x-1)-3(x+2)=12$; Error-prone question 2: Solving the equation $3(x+4)-2(x-1)=8$.

In order to do more questions, many students only check the answers after completing the new questions. If they are wrong, they will directly change the answers without considering the reasons for the errors. The students’ error points in solving the first equation focus on the omission of brackets and the error of symbols. The second equation examines the removal of brackets, move terms, and collect like terms. The rules are exactly the same as the first question. If the student only does the questions, even if he does more new questions, he will still make mistakes in the removal of brackets and symbols. Through the comparison of this kind of same type of mathematical errors, teachers can make students intuitively see and carefully sort out an error, so as to master the question-solving methods of a class of questions. In the long run, students will naturally abandon the inefficient learning method of ‘focus more on doing questions than on reviewing them’, and incorporate the collection and correction of mathematical errors into their daily learning, so as to truly realize doing a question and meeting a kind of question.

4.1.3 Hierarchical guidance, stimulate learning motivation

Education should pay attention to the individual differences of students. For different students, teachers should adopt different coping strategies. The establishment and management of MENB also need hierarchical guidance. Teachers should not treat all students with the requirement of "one size fits all", but should combine the learning situation of students at different levels, guide them in layers, accurately stimulate their internal motivation, so that every student can feel the practical value of the MENB.

For excellent students, guide them to realize that the MENB is a key tool to break through the bottleneck of learning and improve the knowledge system. Taking the equilateral triangle judgment error-prone question in the second grade of junior high school as an example: given AB=DE, ∠B=∠DEF, add a condition to make ΔABC≅ΔDEF. When the excellent students sort out the mathematical errors, they can focus on combing the applicable conditions and error-prone traps of the congruent triangle judgment, and optimize the rigor of thinking through the mathematical errors to break through the bottleneck of the problem.

For the intermediate students, taking the basic questions as the breakthrough point, through the positive feedback of 'sorting out the mathematical errors →improve the accuracy of the questions → improve the math scores', the motivation of persistence is stimulated. For example, the line segment calculation error-prone question: known line segment AB=8cm, point C is a point on AB, BC=3cm, find the length of AC; variant question: known line segment AB=8cm, point C on the straight line AB, BC=3cm, find the length of AC. After finishing, the intermediate students can find the key difference between "line segment" and "straight line".

For students with learning difficulties, it is necessary to reduce the threshold of sorting, and only require them to record the simplest basic errors, such as the error-prone questions of the addition and subtraction of rational numbers in the first grade of junior high school: -5+3, -7-2, without complex analysis, as long as the 'symbol sees clearly' is marked. Let the students with learning difficulties feel that it is not difficult to do the mathematical errors, eliminate the fear of difficulties, gradually shift from passive coping to active trying, and be willing to sort out the mathematical errors.

4.2 Standardize the Behavior of Sorting, Cultivate the Habit of Using

4.2.1 Unified specification, build a standardized framework

At present, the biggest problem for students to sort out the mathematical errors is that there is no standard, only in the form. Most students only copy the questions and answers, do not analyze the wrong reasons, do not mark the knowledge points, and the mathematical errors become the wrong transcripts, completely losing the review value. Teachers should build a simple and easy-to-operate standardized collation framework for students in the first and second grades of junior high school, clarify the core content that must be included in each wrong question, let students know how to organize and what to organize, and avoid mechanical copying. The standardized framework is 'original question + correct answer + error reason + corresponding knowledge point', Taking the error-prone problem of eliminating denominator in unary linear equation as an example. The original question: solving the equation $\frac{x-1}{2}-\frac{x+1}{3}=1$. Correct solution: removing the denominator to get $3(x-1)-2(x+1)=6$, removing the parenthesis to get 3x-3-2x-2=6, moving the term to merge to get x = 11. Error reason: when removing the denominator, the constant term 1 is omitted, and the symbol is wrong when removing the parenthesis. Corresponding knowledge points: the solution of unary linear equation, the rule of denominator removal and bracket removal. Through classroom demonstration and excellent MENB display, teachers enable students to master standardized collation methods, so that students can think about the causes of errors and related knowledge points in the process of collation, so that the MENB can truly become a learning tool.

4.2.2 Strengthen process guidance and cultivate stable habits

There are common problems of delay and discontinuity in students' sorting out mathematical errors. They either temporarily sort out before the examination or sort out only when they think of it. After accumulating too many mathematical errors, they will forget the wrong ideas and cannot make up for the loopholes in time. Teachers need to strengthen the process guidance, formulate a fixed arrangement rhythm for students, cultivate the habit of timely arrangement and regular review, arrange the mathematical errors on the same day, and review and consolidate the mathematical errors every week.

For example, on the day of mathematics class, the 'addition and subtraction of the whole formula' is learned. The mathematical errors in the students' homework must be studied by themselves or sorted out after returning home on the same night, so as to avoid forgetting the wrong reasons after too long interval. Every Friday, ten minutes of self-study class are used to let students look through all the mathematical errors sorted out this week, block the answers and do it again to test whether they have mastered them. Taking the error-prone questions of merging similar items as an example, after sorting out the mathematical errors on the day, $3x^2y-2xy^2+5x^2y$ is recalculated on the weekend. If $8x^2y-2xy^2$ can be quickly calculated, it shows that the merging rules of similar items have been mastered. If you still make mistakes, re-mark the focus and strengthen the review. Through the requirements of normalization, let the mathematical errors arrangement from the teacher's task, into a fixed habit of students' autonomous learning.

4.2.3 Grasp the cause of the error, do a good job of knowledge point labeling

Error cause analysis and knowledge point labeling are the core links of error sorting, and they are also the worst part of the survey. Most students will only use carelessness and carelessness to summarize the reasons, and cannot accurately locate the root causes of errors. Teachers guide students to accurately analyze the causes of errors and avoid vague expressions. At the same time, they are required to mark the corresponding knowledge points, so that the errors are closely related to the knowledge system. The causes of errors can be simply classified, such as unclear concepts, calculation errors, problem-solving errors, deviation of ideas, or formula errors.

Taking the error-prone problem of congruent triangle as an example, it is known that AB=AD, BC=DC, to prove the AC bisection ∠BAD . Students only use SSA to prove the congruency, resulting in a proof error. The precise positioning error is due to the unclear concept of the congruent triangle determination method, which confuses the applicable conditions of SSS and SSA. Corresponding to the knowledge point, that is, the judgment theorem of the congruent triangle SSS.

For example, the angle calculation error-prone question, known ∠AOB=60°, ∠AOB is divided by OC, and the degree of ∠AOC is calculated. The students' wrong answers were 30° and 120°. The reasons for the errors were the correct calculation but the lack of steps and the wrong division of the examination questions. The precise annotation is not carefully examined, and the 'bisector' keyword is not clearly seen, and the corresponding knowledge point is the definition of the angular bisector. Through classroom demonstration and one-to-one error correction, teachers enable students to learn to accurately attribute and annotate knowledge points, so as to truly organize a question and thoroughly understand a knowledge point.

4.3 Optimize the Application Strategies to Improve the Effectiveness of the Use of MENB

4.3.1 Teach students the classification method, establish the mathematical error files

Sorting out the mathematical errors is not to copy the mathematical errors and the correct answers to the mathematical errors, but also to carefully analyze the causes of the errors, as well as the knowledge points examined by the questions, and take specific strategies to remedy them. At this time, teachers need to guide students to sort out scattered mathematical errors into systematic mathematical errors files, so that wrong resources can truly change from a pile of mathematical errors to a set of learning materials. A basic error sorting process should include: title, wrong solution, wrong cause analysis, positive solution, similar title, summary and reflection.

To establish the mathematical errors file [13], we must first completely retain the question information. Many students only write answers, do not copy the question, or only mark the page number when sorting out. When they can not find the original question and understand the situation when reviewing, the MENB will lose its use value. When recording questions, for questions with long stems, key conditions can be extracted, core information can be retained, and records can be simplified without affecting the understanding of the meaning of the questions. You can also use the way of cutting papers and pasting exercises to save time and improve efficiency.

After completing the basic arrangement, students who have the ability to learn can actively supplement 1-2 similar variant questions to further consolidate the method and strengthen their understanding. Teachers can also regularly extract high-frequency errors from students' error files to form a small-scale test paper to test whether students really master them and make use of the error resources.

In addition, students can also record their review time, learning experience or self-encouragement words in the error files, and gradually improve their autonomous learning ability and error management level in the process of continuous review, reflection and summary. Table 5 is the error file template that can be referred to. Students do not have to stick to the fixed format. They can adjust flexibly according to their own habits. As long as they can help themselves clearly sort out errors and review and consolidate efficiently, it is the most suitable way for them.

Table 5: Error file template

<table>
<tr><td rowspan="2">Knowledge points:</td><td>Source of mathematical errors:</td></tr>
<tr><td>Time of errors sorting out:</td></tr>
<tr><td>Questions:</td><td rowspan="3">Error cause analysis and method summary:</td></tr>
<tr><td>Correct answer process:</td></tr>
<tr><td>Variant mathematics exercises:</td></tr>
</table>

4.3.2 Standardize the review process and form a closed loop of 're-examine-fill learning gaps'

It is common for students to review mathematical errors only to see but not to do. If they look at the answers again, they think they will, and the actual test is still wrong. Teachers should standardize the review process of mathematical errors, so that students can form a complete closed loop of 'redoing mathematical errors → checking mastery → consolidating key points', and put an end to false mastery.

Review steps: 1) block the answer, do the error question independently; 2) Can do right, marked as mastered, reduce the frequency of review; 3) If it is wrong, re-analyze the cause of the error, sort out the ideas, focus on labeling, and consolidate again. Review the rhythm to maintain the day finishing, weekly review, monthly review, pre-examination focus.

Taking the error-prone question of the analytic formula of the linear function as an example, the answer is blocked when reviewing, and the undetermined coefficient method is used to solve the problem. If the correct analytic formula can be calculated quickly, it shows that it has been mastered; if there are still errors, it is necessary to review the knowledge point labeling and error analysis, and practice again. By standardizing the process, the review of mathematical errors has changed from a cursory observation to an accurate test, and the role of checking omissions and filling vacancies has been truly played.

4.3.3 Strengthen supervision and build a perfect feedback evaluation system

It is difficult for students to persist in sorting out the mathematical errors for a long time. The important reason is the lack of continuous and effective external supervision. If teachers only emphasize the importance of sorting out the mathematical errors orally without actual follow-up and feedback, students are prone to perfunctory, delay and temporary filling. Therefore, teachers must establish a normalized and implementable inspection and evaluation mechanism, so that the management of MENBs can be truly implemented.

In terms of supervision and inspection, teachers should not only stay in reminders and requirements, but also really participate in the process of students' error management. We can adopt the combination of weekly group mutual inspection, monthly teacher centralized review and classroom random spot check to fully grasp the students' arrangement. When checking, it is not only necessary to see whether it has been completed or not, but also to pay attention to the core contents such as error cause analysis, knowledge point labeling, and idea summary, so as to avoid students blindly copying questions and simply listing answers in order to cope with the check.

In terms of evaluation feedback, teachers can use the method of grade evaluation 'excellent, good and qualified' to make students intuitively understand their finishing quality; teachers should reasonably arrange the amount of homework and balance the amount of homework and error management. At the same time, we should strengthen the supervision of students' error sets. Teachers can also take certain reward and punishment measures to praise students who perform well. Timely evaluation can effectively improve students' enthusiasm for managing error sets.

In addition, teachers can also find some excellent MENBs to provide reference for students. Use the role of role models to motivate students and mobilize students' self-confidence in managing error sets. Teachers should also often emphasize the value of the MENB, especially after the exam. Prevent students from negating the value of the wrong question set because of a test landslide. In short, teachers should always remind students of the importance of MENB, subtly influence students, and let excellent students drive other students to gradually form an atmosphere and atmosphere of wrong question management in the class.

4.3.4 Integrate into daily teaching to realize the classroom transformation of error resources

Teachers should deeply integrate error resources with daily teaching, so that students can feel the actual teaching value of MENBs, rather than isolated learning tasks. Only by letting the mathematical errors really come into the classroom and become the teaching content, students will pay more attention to the collation and review, so that the mathematical errors from the extracurricular tasks into the class necessary.

In daily teaching, teachers can regularly collect and summarize typical problems with high frequency and concentrated errors in students' MENBs, and adapt these students' own real errors into classroom examples, in-class test questions or special consolidation exercises. For example, in the key and difficult content of 'linear function and geometric synthesis' in the second grade of junior high school, students generally make mistakes in reading image information, solving analytical formulas, combining with triangles or quadrilaterals, and so on. Teachers can take these high-frequency mathematical errors as the key content of classroom explanation.

For example, it is known that the image of the linear function $y=kx+b$ passes through points $A(1,3)$ and $B(-2,3)$, and intersects with the x-axis at point C to find the area of ΔAOC. This question comes from the student's MENB, and the error points are very typical. One is to find the analytic formula era into the calculation error; the second is to omit the key step of finding the intersection point C with the x-axis when $y=0$; thirdly, the correspondence between the bottom and the high of the triangle area is confused. Taking this question as an example in the classroom, teachers analyze the causes of errors, standardize steps, and sort out ideas one by one. Students will be more focused, more resonant, and more profound when listening to lectures because they or their classmates have missed them.

In the unit review class, teachers can break the traditional fixed mode of "summing up knowledge points-exercising examples", and directly review with students' mathematical errors as the main line. Classify the most mathematical errors sorted out by students in this unit according to knowledge points, sort out and compare them one by one, and focus on what is wrong, so that the review class is more targeted. For example, in the review of factorization and fraction simplification in the second grade of junior high school, students generally have problems in formula confusion, incomplete decomposition, and fraction symbol processing. Teachers can select several typical mathematical errors to lead students to analyze ideas, summarize methods, and improve review efficiency.

After each examination, teachers should guide students to combine their own MENBs, systematically sort out the points of loss in this examination, and find out which questions have been sorted out but made mistakes again by comparing the MENBs, so that students can clearly see their own knowledge loopholes and weak links, and formulate the next stage of review and consolidation plan accordingly. At the same time, teachers can also design targeted compensation exercises according to the overall error situation of the class to help students completely clear the knowledge blind spot.

Integrating the wrong question resources into daily teaching can not only make students realize that the mathematical errors they sort out are the focus of the classroom, but also significantly enhance the initiative and effectiveness of the use of mathematical errors. It can also make teachers more accurately grasp the learning situation and optimize the teaching content, so as to truly realize the promotion of teaching and learning by mistakes, and make the mathematical errors run through the whole process of preview, classroom, review and detection.

5. Conclusion

Through the combination of questionnaire survey and teacher-student interview, this paper systematically explores the cognitive attitude, behavioral habits and application strategies of junior high school students' use of MENBs. The research results objectively reflect the real situation of the use of junior high school students' MENBs.

From the perspective of cognition, students have obvious deviation in the value cognition of the MENB, and their active consciousness is weak. Most students know that not sorting out the mathematical errors in time will lead to the repetition of similar errors, but only nearly half of the students recognize the value of the mathematical errors, and more than half of the students do not establish the core cognition of the equivalence between the mathematical errors and the knowledge loopholes. They still adhere to the learning concept of doing more questions and thinking less. The willingness to actively learn scientific error management methods and regularly review the wrong questions is generally low. The lack of cognitive level is the root cause of restricting the efficient use of mathematical errors.

From the perspective of behavior, the arrangement of students' mathematical errors is a mere formality, and the implementation of the core links is seriously insufficient. About half of the students can complete the basic behavior of special MENB preparation, timely collation, regular combing, etc., but the performance is very poor in the two core links of error cause reflection and knowledge point labeling. Most students only copy the questions and correct the answers, do not dig deeper into the root of the errors, and do not associate the errors with the knowledge points. The MENB is reduced to a formal task and cannot play the core role of checking omissions and filling vacancies.

From the perspective of application strategies, students lack scientific error management methods, and the implementation of deep learning strategies is absent. Students have a relatively good habit of reviewing mathematical errors only before the examination. The implementation rate of deep learning strategies such as error screening, classification and sorting, redo test, and variant consolidation is generally low. Many students have not carefully analyzed the cause of the error, and have not classified and sorted out, and even will not consolidate knowledge by redoing the mathematical errors and variant exercises. The application value of the MENB has not been fully explored.

From the perspective of teaching, teachers recognize the value of the MENB, but the guidance and supervision mechanism is not perfect. The teachers interviewed agree with the teaching value of the wrong question resources and will also carry out basic guidance. However, there are some problems, such as lack of specific method demonstration, lack of continuous supervision and inspection, and inadequate hierarchical guidance. It is difficult to help students shift from 'passive collation' to 'active application'.

Based on the above problems, this study proposes targeted optimization strategies from four dimensions: establishing scientific error management concepts, standardizing behavior and habits, optimizing application strategies, and integrating into daily teaching. It aims to provide practical reference for junior high school mathematics teachers to optimize the teaching guidance of MENBs, improve students' error management ability, make up for knowledge loopholes, and improve mathematics learning efficiency.

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