

The Relationship between the Improvement of High School Mathematics Performance and Students' Self-learning Ability

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ABSTRACT

Mathematics is a subject that cultivates six core competencies in students: mathematical abstraction, mathematical modeling, mathematical analysis, mathematical computation, logical reasoning, and intuitive imagination. In the process of learning mathematics, developing good self-learning abilities and mastering effective methods and techniques for learning mathematics can help high school students improve their academic performance in mathematics. This paper deeply analyzes the intrinsic relationship between the improvement of high school mathematics scores and students' self-learning abilities. Through rigorous theoretical analysis, it systematically elucidates the key value of self-learning abilities in the process of high school mathematics learning. The study shows that students' self-planning abilities help them allocate their mathematics study time reasonably and control their learning progress accurately, thereby significantly improving learning efficiency. Self-monitoring abilities enable students to keenly detect problems that arise during the learning process and adjust their learning strategies in a timely and flexible manner, effectively ensuring learning outcomes. Self-reflection abilities prompt students to deeply summarize their learning experiences and lessons, and comprehensively deepen their understanding and application of mathematical knowledge. These three abilities are interwoven and work together to form a complete self-learning ability system for students, playing a crucial role in improving high school mathematics scores. Strengthening the cultivation of students' self-learning abilities can effectively help students master mathematical knowledge, enhance their mathematical thinking level, and steadily improve their mathematics scores, thereby laying a solid foundation for their future learning and long-term development.

KEYWORDS

High school mathematics; Performance improvement; Self-learning ability

In the high-school education system, mathematics, as a fundamental and highly challenging core subject, undoubtedly holds an important position. Mathematics is not only a key subject for pulling points in the college entrance examination but also an important way to cultivate students' logical thinking and their abilities to analyze and solve problems. However, the reality is that many students face numerous difficulties on the path of high-school mathematics learning, and it is extremely difficult for them to improve their performance. Looking back on the traditional teaching models in the past, they often overly emphasized one-way knowledge transfer, to a certain extent, neglecting the cultivation and development of students' self-learning ability. With the continuous innovation and progress of educational concepts, more and more educators have deeply realized that the level of students' self-learning ability, like a key, profoundly affects whether their mathematics performance can achieve a qualitative leap. Students with strong self-learning abilities are like having a navigator to independently explore the ocean of knowledge. They can actively and vigorously explore the depth and breadth of mathematical knowledge, efficiently and accurately solve various mathematical problems. An in-depth exploration of the relationship between the improvement of high-school mathematics performance and students' self-learning ability not only helps to accurately reveal the internal logic and laws behind mathematics learning but also provides an indispensable theoretical basis for optimizing teaching strategies and improving students' learning methods, ultimately promoting the all-round improvement of students' mathematical literacy.

1 The Influence of the Constituent Elements of Self-learning Ability on High School Mathematics Performance

1.1 Self-planning Ability

Self-planning ability is the cornerstone of students' self-learning ability. In high-school mathematics learning, students with good self-planning ability can formulate detailed and reasonable learning plans based on their own learning situations and curriculum requirements. They will clarify learning goals for each stage. For example, when learning the chapter on functions, they determine the types of functions to be mastered, understand the properties of functions, and the mathematical problems that can be solved using functions. At the same time, they rationally allocate learning time, arranging previewing, reviewing, doing exercises, and other links in an orderly manner. For instance, during previewing, they understand the framework of knowledge points in advance and mark the points of confusion, so as to listen attentively to key points in class; after class, they review in a timely manner and consolidate the learned knowledge by doing exercises. This well-organized learning plan enables students to maintain a clear train of thought during the mathematics learning

process, avoid blind learning, greatly improve learning efficiency, and provide a strong guarantee for the improvement of mathematics performance.

1.2 Self-monitoring Ability

Self-monitoring ability is a key ability for students to comprehensively supervise and precisely control their learning behaviors and states during the learning process. In the challenging journey of high-school mathematics learning, students need to maintain a high level of self-awareness at all times and closely monitor their learning progress. When students are doing mathematics exercises, those with strong self-monitoring ability can, like keen observers, precisely detect whether their problem-solving ideas deviate from the correct track and whether the problem-solving methods they use are appropriate and efficient. Once they encounter difficult problems and cannot find solutions after thinking hard for a long time, they will not blindly continue to persevere in the wrong direction. Instead, they will quickly activate the self-reflection mechanism, deeply think about whether there are deviations in their understanding of relevant knowledge points, or whether the current problem-solving method is not the optimal solution, and whether they need to change their thinking perspectives and try other problem-solving paths. In the crucial link of classroom listening, such students also demonstrate strong self-monitoring ability. They can constantly self-monitor whether their attention is highly concentrated and whether they are keeping up with the teacher's teaching rhythm and ideas. Once they find that their attention is distracted, they will immediately take effective adjustment measures, such as taking notes and actively participating in classroom interactions, to quickly bring their attention back to the classroom, ensuring that they do not miss any important knowledge points and problem-solving ideas.

1.3 Self-reflection Ability

Self-reflection ability is the ability of students to summarize and think about their learning processes and results. In high-school mathematics learning, every time they complete an assignment, a test, or the learning of a chapter, students who are good at self-reflection will review their learning processes. They will analyze which knowledge points they have mastered well and which areas still have deficiencies. For wrong questions, they do not just correct the answers but also deeply think about the reasons for the mistakes, whether it is due to forgetting knowledge points or inappropriate problem-solving methods. For example, in the study of solid geometry, if they make mistakes in questions about proving the perpendicularity of a line and a plane, they will reflect on whether their understanding of the relevant determination theorem is accurate and whether the logical reasoning in the proof process is rigorous. Through continuous self-reflection, students can summarize experiences and lessons, avoid making the same mistakes repeatedly, and at the same time deepen their understanding and application of mathematical knowledge, gradually improving their mathematics performance.

2 Manifestations of Insufficient Self-learning Ability in High School Mathematics Learning

2.1 Lack of Clear Learning Goals and Plans

Among the large number of high-school mathematics learners, some students are like ships losing their course in the vast ocean, lacking clear learning goals. They are merely satisfied with passively following the teacher's teaching progress step by step, and have never deeply considered their own advantages and disadvantages in mathematics learning, and are completely confused about which knowledge and skills should be focused on mastering at each learning stage. Taking the learning of the chapter on sequences as an example, they do not know how proficient they need to be to calmly deal with various types of questions, whether it is the simple solution of the general term formula of a sequence, complex sequence summation problems, or the comprehensive application of sequences with functions, inequalities, and other knowledge. At the same time, these students also have serious deficiencies in the formulation and implementation of learning plans. They are unable to arrange their learning time reasonably, often showing randomness and disorder in learning. They may do a few math problems on a whim today and then abandon mathematics learning tomorrow because they are attracted by other things. The entire learning process lacks coherence and systematicness. This unplanned learning method makes their learning of mathematical knowledge like scattered sand, unable to form an effective knowledge system, ultimately resulting in extremely low learning efficiency and making the improvement of mathematics performance out of reach.

2.2 Difficulty in Effectively Monitoring the Learning Process

In high-school mathematics classrooms, some students seem like bystanders outside the learning process, lacking basic

self-monitoring awareness. When the teacher is explaining the derivation process of complex mathematical formulas on the podium, they may miss the key derivation steps inadvertently due to distracted thoughts and inattentiveness, but they are completely unaware that they have missed important knowledge. In the process of doing homework after class, when encountering difficult problems, these students often lack the spirit of independent thinking and in-depth exploration. They eagerly look at the answers without seriously thinking about where the problems lie in their problem-solving ideas. They also lack the ability to judge whether their learning progress is reasonable and whether their learning methods are scientific and effective. Facing various problems in learning, they do not know how to adjust their learning strategies in a timely manner according to the actual situation, allowing problems to accumulate and ferment continuously, ultimately seriously affecting the effect of mathematics learning and hindering the improvement of mathematics performance.

2.3 Lack of Emphasis on Reflection and Summary after Learning

After completing mathematics assignments or exams, many students only focus on right or wrong answers and scores, but rarely realize the importance of learning reflection. They lack in-depth analysis and summary of their thinking patterns and angles during the problem-solving process. For wrong questions, they just mechanically copy down the correct answers, simply thinking that remembering the answers is enough, without delving into the root causes of the mistakes, whether it is due to poor knowledge mastery, lack of problem-solving skills, or limitations in thinking patterns. For example, in the study of analytic geometry, after finishing a question about the positional relationship between a straight line and a conic section, they do not take the initiative to think about whether the method they used in the problem-solving process is the optimal solution and whether there are other simpler and more efficient solutions. This disregard for learning reflection makes it impossible for students to extract valuable experiences and lessons from their learning experiences, difficult to accurately identify their learning loopholes, and even more impossible to make targeted improvements and enhancements. As a result, they gradually fall into a predicament in the path of mathematics learning, and the improvement of their mathematics performance is seriously hampered.

3 Strategies for Improving Students' Self-learning Ability to Enhance High School Mathematics Performance

3.1 Guiding Students to Develop Reasonable Learning Plans

As the guide on students' learning path, teachers shoulder the important responsibility of helping students recognize the importance of formulating learning plans and should carefully guide students to develop scientific and reasonable high-school mathematics learning plans. First of all, teachers should guide students to conduct a comprehensive and in-depth self-assessment of their mathematics learning situations. This includes a detailed review of their knowledge mastery, clarifying which knowledge points have been mastered proficiently and which still have weak links; an objective judgment of their learning abilities, understanding their learning speeds, comprehension abilities, and thinking characteristics. Then, based on the assessment results and closely combined with the requirements of the curriculum standards, teachers help students determine practical and specific learning goals. For example, setting the goal of comprehensively mastering the mathematical knowledge of a certain chapter within a month and being able to proficiently use this knowledge to solve medium-difficulty problems, including being able to accurately answer relevant proof questions, calculation questions, and application questions. Next, the overall learning goal is refined and decomposed into daily or weekly small goals, and students are guided to arrange their learning time reasonably. During the implementation of the learning plan, teachers should regularly check the completion of students' plans and provide targeted guidance and suggestions in a timely manner. For students with good implementation, full affirmation and encouragement should be given to strengthen their learning enthusiasm; for students who encounter difficulties or deviate from the plan, patiently help them analyze the problems and adjust the learning plan, thus helping students gradually develop good learning habits, effectively improve their self-planning ability, and lay a solid foundation for enhancing mathematics learning efficiency and performance.

3.2 Cultivating Students' Learning Monitoring Awareness and Ability

Teachers can comprehensively cultivate students' learning monitoring awareness and ability through a two-pronged approach of classroom guidance and after-class tutoring. In classroom teaching, teachers can skillfully set a series of questions to guide students to deeply think about their learning processes. For example, after explaining a difficult math problem, ask students: What was your initial thinking in the problem-solving process? What difficulties did you encounter? How did you overcome these difficulties? Are there any other better problem-solving methods? Through this way,

gradually guide students to pay attention to their thinking processes and cultivate their self-monitoring awareness. After class, teachers require students to carefully record their learning situations, including the investment of learning time, the completion progress of learning content, the difficult problems encountered, and the methods of solving these problems. Regularly organize students to carry out learning summary and exchange activities, allowing students to share their monitoring experiences and methods during the learning process, and learn from each other. During the exchange process, teachers should provide timely comments and guidance to help students continuously improve their learning monitoring strategies, thereby improving students' self-monitoring ability and effectively ensuring the quality and effectiveness of mathematics learning.

3.3 Encouraging Students to Actively Conduct Learning Reflection

Teachers should actively encourage students to develop good habits of active reflection in high-school mathematics learning. Special reflection assignments can be assigned, requiring students to conduct a comprehensive and in-depth reflection on their learning processes and results after completing assignments or exams. For example, asking students to carefully analyze the reasons for wrong questions in a certain mathematics exam, whether it is due to misunderstandings of knowledge points, calculation errors, or inappropriate problem-solving methods; summarize which knowledge points have obvious loopholes and which aspects of problem-solving methods need to be improved and optimized. At the same time, teachers can organize various forms of learning reflection exchange activities, such as group discussions and class sharing sessions, to give students the opportunity to share their reflection results, inspire each other, and broaden their thinking horizons. During the process of students' sharing, teachers should give timely affirmation and encouragement, guide and enhance the depth and breadth of students' reflection, help students better understand the essence of mathematical knowledge, master scientific and effective learning methods, improve their self-reflection ability, and thus effectively promote the steady improvement of mathematics performance.

4 Conclusion

To sum up, there are numerous close connections between the improvement of high-school mathematics performance and students' self-learning ability. The three core elements of self-learning ability, namely self-planning, self-monitoring, and self-reflection, deeply affect students' mathematics learning effects from different dimensions and levels. Currently, students generally have problems of insufficient self-learning ability in high-school mathematics learning, specifically manifested as a lack of clear learning goals and plans, difficulty in effectively monitoring the learning process, and a lack of emphasis on reflection after learning. By adopting a series of practical strategies such as guiding students to develop reasonable learning plans, cultivating students' learning monitoring awareness and ability, and encouraging students to actively conduct learning reflection, students' self-learning ability can be effectively improved, thereby providing strong impetus for improving high-school mathematics performance. In future high-school mathematics teaching practices, teachers should always place the cultivation of students' self-learning ability in an important position, continuously explore and innovate teaching methods and means, and lay a solid foundation for students' lifelong learning and long-term development.

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