

Psychological States of Primary Education in Developing Mathematical Thinking

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Abstract: The development of mathematical thinking in primary education is not just a cognitive process but also an emotional and psychological journey. Primary school is a crucial period in a child's life, as it forms the foundation for future learning and cognitive development. Psychological states—such as motivation, self-confidence, anxiety, and problem-solving skills—play a significant role in shaping a child's ability to understand and engage with mathematical concepts. This paper explores how various psychological states impact the development of mathematical thinking in primary education, examining both positive and negative influences. Additionally, it discusses strategies for educators to foster supportive psychological environments that encourage mathematical growth in young learners.

Keywords: Mathematical thinking, psychological states, motivation, anxiety, self-confidence, primary education, cognitive development, problem-solving, learning environment

Mathematical thinking is a fundamental skill that supports a wide range of intellectual and practical competencies. In primary education, the development of mathematical thinking goes beyond mere memorization of numbers or formulas. It involves the cultivation of problem-solving abilities, logical reasoning, and abstract thinking. While cognitive development is crucial in this process, psychological states—such as motivation, self-confidence, anxiety, and emotional responses to challenges—also significantly influence a child's mathematical journey. Psychological factors in primary education can either promote or hinder mathematical thinking. For instance, a child who feels confident in their abilities is more likely to engage actively with mathematical problems, whereas a child who experiences anxiety or frustration may struggle with mathematical concepts, even if they have the necessary cognitive skills. Therefore, understanding the psychological states that affect the development of mathematical thinking is essential for educators to create an environment that supports positive learning experiences.[2]

This paper aims to explore the psychological states that influence the development of mathematical thinking in primary education and provide insights into how teachers can foster these states to enhance students' mathematical abilities.

Motivation is a key psychological state that influences how students approach mathematical tasks. It determines their willingness to engage, persist, and invest effort in solving mathematical problems.

Intrinsic vs. Extrinsic Motivation: Intrinsic motivation arises when students find joy or satisfaction in the process of learning mathematics itself, while extrinsic motivation is driven by external rewards or pressures (such as grades or parental approval). Research suggests that intrinsic motivation is more effective in fostering long-term mathematical thinking, as it encourages students to engage with the material for personal satisfaction rather than external rewards.

Mastery Goal Orientation: Students with a mastery goal orientation focus on learning and improving their skills, whereas students with a performance goal orientation are more concerned with proving their ability compared to others. A mastery-oriented mindset is beneficial for mathematical thinking because it encourages persistence and resilience when students face difficulties.

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Teacher's Role: Teachers can foster motivation by creating a supportive environment where students are encouraged to explore mathematics through meaningful, challenging problems, rather than simply focusing on rote learning. Providing opportunities for students to see the relevance of mathematics to real-world problems can also enhance motivation.

Self-confidence plays a crucial role in how children approach mathematical tasks. When students believe in their ability to succeed, they are more likely to take risks, make mistakes, and persist through challenging problems. In contrast, a lack of self-confidence can lead to avoidance of math-related tasks and reduced engagement. The concept of a "growth mindset," developed by psychologist Carol Dweck, suggests that students who believe their abilities can improve through effort and practice are more likely to succeed in mathematics.[1,78] Encouraging a growth mindset in the classroom helps students see mistakes as opportunities for learning rather than failures. Teachers can boost students' self-confidence by providing positive reinforcement, emphasizing effort over innate ability, and creating a classroom culture that celebrates perseverance. Offering constructive feedback and framing mistakes as learning opportunities can help students view challenges in mathematics as surmountable rather than threatening.

Mathematical anxiety is a psychological state characterized by feelings of fear, tension, or nervousness when faced with mathematical tasks. This anxiety can significantly hinder a student's ability to think critically and solve problems, as it interferes with concentration and may lead to avoidance behaviors. Math anxiety can stem from previous negative experiences with mathematics, pressure to perform well, or a lack of positive reinforcement from teachers or peers. Social and cultural factors, such as stereotypes about "who is good at math," may also contribute to a student's fear of mathematics. Pupils with math anxiety may experience physical symptoms such as sweating or increased heart rate when confronted with math problems. Cognitive effects include a reduced ability to recall mathematical facts or strategies under pressure, which can hinder problem-solving and mathematical reasoning.

To address math anxiety, teachers can create a low-pressure, supportive environment where students feel comfortable making mistakes. Emphasizing effort over performance and using games or interactive activities that reduce anxiety can help students build confidence in their mathematical abilities. Gradual exposure to increasingly challenging problems, paired with positive feedback, can help students overcome their fears. Mathematical thinking involves not only cognitive skills but also emotional regulation. When students encounter problems that are difficult or unfamiliar, they may experience frustration, confusion, or other negative emotions. How students regulate these emotions impacts their ability to continue working on the problem and find solutions.

The ability to manage emotions during problem-solving tasks is an essential skill for developing mathematical thinking. Students who can regulate their emotions are more likely to persist through challenges, adapt to new strategies, and experience "aha" moments of insight.

The psychological states of students in primary education—such as motivation, self-confidence, anxiety, and emotional regulation—play a significant role in the development of mathematical thinking. By creating a positive, supportive learning environment and fostering a growth mindset, teachers can help students build the psychological resilience necessary for engaging with mathematical concepts. Addressing math anxiety, enhancing self-confidence, and motivating students to persist through challenges are critical components of supporting students in their mathematical journeys. Ultimately, a well-rounded approach that includes both cognitive and emotional development can lead to more effective and enjoyable learning experiences in mathematics, laying the foundation for future academic success.

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