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The Significance of the Psychological Factor in Mathematics Educational Process and Its Impact On Students' Academic Performance

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Abstract

This study provides insights on the psychological factors that students are exposed to when learning mathematics, and how these factors negatively affect their performance and academic progress, as well as their performance in practical real-life situations later on. As well as introducing the necessary role of the teacher in reducing and overcoming these difficulties, which helps in a smooth flow of information and an easy engagement of students to build in confidence, creativity and ability to analyze and apply what they have learned in real life situations. Lastly, this study comes up with suggestions that may help students to overcome any psychological difficulties in their learning process.

Keywords: *Learning Difficulties, Teaching Mathematics, Math Anxiety, Dyscalculia.*



1- Introduction

Mathematics is the heart of all sciences; it appears in different life stages, sectors, and careers such as agriculture, economics, health and engineering. Mathematics is also a universal symbolic language that incorporates all cultures and civilizations, regardless of their diversity, advancement, or development (Rossnan, 2006). Mathematics' importance stems from the fact that it is one of the most important teaching subjects allowing students to infer and solve problems using knowledge, rules, mathematical laws, and mathematical thinking methods, as well as generalizing this knowledge to various daily life activities (Alhussaini, 2021).

The study of mathematics depends on understanding some basic information on which the mathematical structure is based. The different laws, relationships and definitions are all aspects of knowledge that students must acquire from the entry level, in order for them to facilitate their acquisition of other aims in higher mental operations (Hifni, 2017). Although entry knowledge and information acquisition are the lowest levels of learning, they are essential and necessary because they establish the foundation for mathematical growth and achievement of higher goals in the future (Nejem, 2020).

On the other hand, mathematics is one of the most difficult subjects for students to acquire, particularly at the primary level, resulting in creating a fear of the subject as well as a tendency to avoid studying it. Hence, it is important to think of a good methodology of teaching mathematics that suits the 21st century requirements and solves any obstacles that may reflect student's performance negatively (Mutlu, 2019).



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Therefore, this study focuses on the significance of the psychological aspect in the mathematical teaching process and its clear impact on students' lack of confidence and sensitivity to the topic in particular. Additionally, this study aims at formulate and suggest solutions for the major problems in teaching mathematics that affects the student's performance in practical fields.

2- Research problem & Questions

According to studies and research, many students have psychological challenges and difficulties in studying and learning mathematics, these problems often begin in elementary school, continue through secondary school until university stage. Problems and challenges in learning mathematics have an impact on every student's daily, professional, and practical life in addition to his academic career (Affouneh, 2015). Despite the importance and complexity of the impact of the psychological challenges, attention giving to them was not as hopeful, especially when compared to the attention given to other difficulties, such as reading difficulties (Scarpello, 2007).

Thus, the research questions can be presented as follows:

- 1- What are the main causes of having psychological issues in the mathematics educational process?
- 2- What are the suggestions for overcoming students' psychological issues to learning mathematics?



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3- Background overview

3.1 Psychological issues in learning mathematics

Student learning problems are affected by a combination of factors, both internal and external. The student's psychological condition including mathematics anxiety, self-efficacy, and value attitudes are key components that are sometimes overlooked throughout the process of analyzing mathematics-learning difficulties (Affouneh, 2015).

The difficulty of learning mathematics denotes a failure in students' capacity to conduct mathematical operations despite having adequate intelligence, and this problem may be attributable to psychological issues such as stress and fear when dealing with mathematics in daily life (Afdal et al., 2019).

Mathematics anxiety is a form of stress experienced by students who are involved in subjects that require mathematical calculations. It can result in rejection, avoidance, psychosomatic reactions, inability to optimize memory, motivation loss, and other potentially serious outcomes (Mehran, 2018). Additionally, student's subjective wellbeing condition is influenced by their belief in their ability and self-esteem related to the learning process of mathematics, which has an impact on learning achievement (Ardi et al., 2019).

The success or failure of an educational technique aimed at teaching mathematics is also determined by the psychology of the educated individual. Students who have a psychological problem with mathematics create compulsive responses to mathematical circumstances that signal rational difficulty. Yet, their actual performance remains unknown due to the negative expectancy component. As a



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result, before determining the existence of true dyscalculia, we must first address the psychological problem of mathematics fear and anxiety, especially when it comes to basic mathematics concepts (Smith, 2022).

3.2 Causes of having psychological issues in learning mathematics

Many studies have found that psychological issues associated to mathematics among students may be caused by the teaching and instructional methods employed with students, as well as a lack of support and encouragement from their parents, and a failure to track their development (Hifni, 2017).

The cycle of mathematical learning starts with logical thinking, and then moves to a practical span of time to understand numbers and geometrical terms. Followed by modeling and translating from different languages to mathematical language, and finally learning rules and guidelines about how to solve mathematical problems (Benleghrib & Lahbari, 2021).

Therefore, any shortfall in this learning cycle will almost result in an unsatisfactory output. In addition, the brain is a well-organized system that relies on data entry, so data flow must be well organized both logically and in a good time line. Psychology and science are viewed as a one package that symbolizes a human need for a successful education, so separating these two would surely harm the educational stability and strength (McCarthy, 2019).

When analyzing the student educational system, it can be found that it consists of three major components, which are psychological needs, brain and outputs in terms of learning outcomes as shown in figure (1).

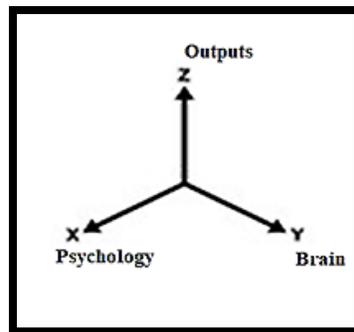


Figure 1. Educational System components.

The psychological needs are representing the x-axis and the brain system represents the y-axis, so working on these two components will actually direct students to the desired positive learning environment. Unfortunately, the psychological needs are the missing point that leads to most of the complications and difficulties in learning mathematics such as confidence, ways of thinking, interest and creativity

3.3 Suggestions for overcoming students' psychological issues to learning mathematics

Differentiation in teaching and evaluating student performance is one of the most important tactics, as it combines all levels of students and instructional tools. As a result, constant assessment can improve students' psychological well-being and engagement.

To build confidence in students, teachers can begin by motivating and encouraging them to ask questions or giving potential solutions to the subject of discussion. Smart students find this method of learning both interesting and challenging. Teachers can then progressively address unfavorable attitudes by instilling desirable principles such as honesty, responsibility, time management, and good classroom behavior.



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Simultaneously, to solve the difficulty of remembering or forgetting scientific terms, teachers can use the storytelling method in teaching; this method can help students to think of other similar scenarios to confirm their understanding of the topic (Ben-jakhdal, 2021).

Teachers can also present some simple and everyday real life examples that help increase motivation, curiosity, and willingness to learn mathematics as well as raise student's confidence and ability of applying mathematics in practical fields.

Most importantly, teachers should attempt to change the student's mindset of learning mathematics from linear and traditional thinking such as the necessity of only passing the subject, to a non-linear thinking approach that will eventually leads to mastering mathematics. This approach could be conducted by planning for a semester project that involves ideas of different projects that are practical and related to mathematics learning outcome, while giving the students the choice whether to choose from the suggested topics or suggest a different topic according to their interest.

3.3.1 Suggested Teaching Methodologies

The main goal is to center students' attention on problem analysis and comprehension, as well as the capacity to translate verbal problems into mathematical language in order to improve students' confidence. As a result, the easiest and most effective way to start the lesson is by explaining the title and providing a short tale example to demonstrate how this topic might be used in real life. Students will find it very engaging to continue listening to the class with enthusiasm when using this strategy (Alnatour & Jarrah, 2021).



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For an example when teaching a chapter called "Trigonometry", teachers can divide the word into three parts as follows: TRI/GONO/METRY. Explaining to students that 'TRI' means three so in this chapter you will be working with triangles. 'GONO' means to reach areas that are scientifically difficult for humans to reach like space, bottom of the ocean or deep distances under the ground. 'METRY' means calculating distances will be used in this chapter.

Since modeling is the main goal of learning mathematics then it is suggested to start explanation with a word problem to teach the translation from any language to the mathematical language. Moreover, teachers should explain the mathematical rules and definitions with a direct number example; in this case, students can understand the meaning of the problem and apply the organized scientific steps to solve it. This technique is illustrated in figure (2). Helping students in learning several languages and modeling by mastering translation can be done by increasing the amount of word problems in both the exercises and exams, which is an international standard, applied at all high-level institutes and international certificates.

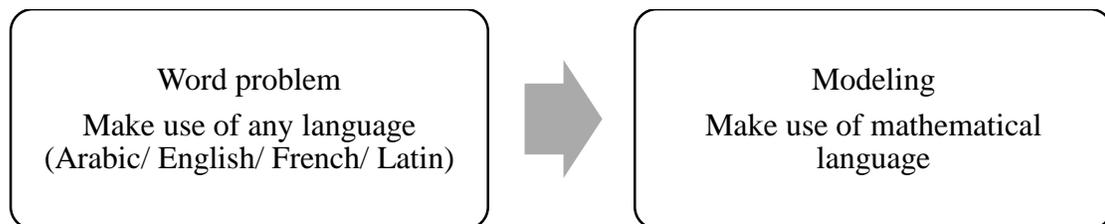


Figure 2. Using the word problem technique in teaching mathematics.



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All of the above-mentioned suggested teaching methods would help the students' psychological and scientific levels, as well as their self-confidence and ability to overcome the psychological barriers of learning mathematics.

Another important teaching method that can be very useful in teaching mathematics is considering letters as elements, which may be combined in different ways and orderings to give different objects and meanings. Then scientific names are selected by specific rules and it is most probably an abbreviation or a hint about the real source of this science.



Figure 3. The three-dimensional number system

Figure (3) shows the letters of the word as the triangle's vertices in the three-dimensional (triangular) number system; their placement and order are crucial. The reader can observe the indicators above or below the letters (Directions/Rays), which can modify the meanings of Arabic phrases even when they are in the same order. This will make it easier for non-Arabic speakers to grasp, especially since most of the words will have less significance.

3.3.2 Suggested Assessment Methodology

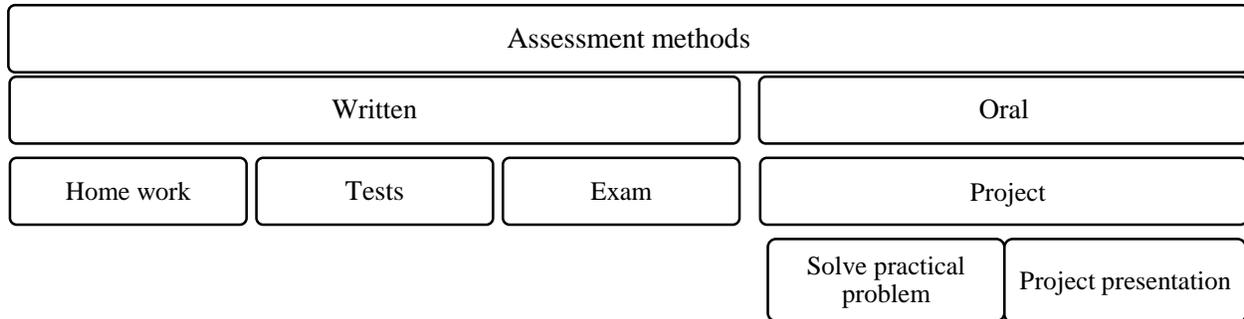


Figure 4. Suggested Assessment methodology.

An assessment is a process of measuring and analyzing the students' performance to provide quality and timely feedback of the teaching process. Assessment methods could be in a written or an oral form. Written assessment may include home works, tests and exams. While oral assessment for example can be applied in group projects by solving practical problems and/or making project presentation.



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4- Conclusion

Mathematics anxiety is a multilayered psychological condition that is influenced by a variety of factors. Furthermore, anxiety that manifests itself in the form of tension and apprehension when dealing with mathematics will have an impact on academic performance in school. Cognitive and affective motivation, as well as the role of parents and teachers, have an impact on children' active participation in mathematics learning. As a result, it can be concluded that the complication of psychological symptoms of anxiety related to mathematics plays a vital role in the smooth learning process of students. On the other hand, students' subjective well-being in school and healthy emotional development are influenced by their mathematical self-efficacy and value views. According to the findings, teachers' employment of various approaches for teaching mathematics, as well as parental encouragement might help students overcome their psychological issues in learning mathematics.

5- Recommendations

- 1- Encourage students to practice mathematics by emphasizing its importance in all aspects of their lives.
- 2- Urging students to solve a variety of problems and questions at home rather than depending solely on classroom lectures, which will help increase their confidence in themselves and their abilities.
- 3- Motivate students to participate in class and respond to questions in order to break down the boundaries of fear, embarrassment, and failure.



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- 4- The need to rethink of the relationship between primary education and students' attitudes and feelings regarding mathematics; by structuring innovative approaches and teaching methods that may help in overcoming any difficultites faced by students.
- 5- Teachers are advised to practice teamwork learning by grouping students into pairs or larger groups in which each student has an equal responsibility. This method will make students feel proud of their achievements and victories, which leads to having a more positive attitude toward their studies.
- 6- Teachers should be encouraged to include technology and modern teaching methods in their mathemtaics learning classes.



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