

Motivation for achievement and its relationship to the ability to solve problems in mathematics Fourth-year intermediate students

الدافعية للإنجاز وعلاقتها بالقدرة على حل المشكلات في مادة الرياضيات

لدى تلاميذ السنة الرابعة متوسط

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Abstract:

This study aimed to explore the nature of the relationship between achievement motivation and problem-solving ability in mathematics among fourth-year middle school students. It also sought to identify the nature of gender differences in achievement motivation within the study sample. The sample consisted of 82 students (36 males and 46 females) from Yamina Chaib Middle School in Bab Ezzouar, Algiers, who were randomly selected from the original study population. The descriptive methodology was adopted, with the study's tools including Abdul Latif Mohamed Khalifa's Achievement Motivation Scale and a mathematics test. The Algerian school system employs a competency-based approach, which relies on modern strategies, including problem-solving strategies. The study's results revealed a statistically significant relationship between achievement motivation and problem-solving ability in mathematics. However, no significant gender differences were found in achievement motivation among the sample.

Keywords: Achievement motivation, mathematical problem solving.

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ملخص:

هدفت هذه الدراسة إلى معرفة طبيعة العلاقة بين دافعية الإنجاز والقدرة على حل المشكلات في مادة الرياضيات لدى تلاميذ السنة الرابعة متوسط، وكذلك معرفة طبيعة الفروق بين الجنسين في دافعية الإنجاز لدى أفراد عينة الدراسة. وقد تكونت عينة الدراسة من 82 فرد 36 تلميذ و 46 تلميذة (متوسطة يمينية شايب باب الزوار الجزائر العاصمة) تم اختيارهم بطريقة عشوائية بسيطة من مجتمع الدراسة الأصلي، وتم اعتماد المنهج الوصفي الذي، وتمثلت أدوات الدراسة في مقياس دافعية الإنجاز لعبد اللطيف محمد خليفة، واختبار مادة الرياضيات باعتبار المدرسة الجزائرية تعتمد على المقاربة بالكفاءات والتي بدورها تبنى باستخدام الاستراتيجيات الحديثة والتي من بينها استراتيجية حل المشكلات، وأسفرت نتائج الدراسة على وجود علاقة ذات دلالة إحصائية بين دافعية الإنجاز والقدرة على حل المشكلات في مادة الرياضيات، وعدم وجود فروق تعزى لمتغير الجنس لدى أفراد العينة.

الكلمات المفتاحية: دافعية الإنجاز، حل المشكلات الرياضية.

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1. Introduction

Education plays a prominent role in the life of individuals and societies due to its important function in preserving a society's heritage. It also serves as a tool for societal progress and development, aiming to enhance all aspects of an individual's personality and enabling them to achieve their desired goals of advancement, prosperity, and well-being. Mathematics is one of the most essential subjects in education due to its significant role in life and its contributions to the advancement and progress of nations (Ibrahim Abu Lughod, 1998).

Some view teaching mathematics as a difficult task due to the abstract nature of its concepts and relationships. It is worth noting that there is no single best method for teaching that suits all contexts and lessons (Ibrahim Al-Faar, 1994).

A learner's ability to solve problems and face challenges is usually linked to a motivation that influences and stimulates them to find a solution

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that is not already provided. Individuals with high motivation tend to work diligently and seriously, achieving greater success in both their daily lives and academic careers.

Based on this, the present study aims to discover the nature of the relationship between achievement motivation and problem-solving ability in mathematics.

2. Problem Statement:

Teaching methods and strategies have been the focus of numerous studies in the field of education. Problem-solving strategy is one of the key strategies in education, as it helps develop learners' abilities to analyze, synthesize, and infer, both in daily life and in academic contexts.

In mathematics, problem-solving strategy requires special and diverse skills and methods in teaching, which involve deep thinking, utilizing motivation, and employing reasoning abilities, such as inductive, creative, reflective, and critical thinking. This also includes an essential aspect of mathematics teaching: the ability to find solutions to mathematical problems, make decisions, predict outcomes, imagine scenarios, and create mathematical models and patterns. These skills provide students with flexible thinking and help transfer learning outcomes to their real lives.

What has drawn our attention most is one of the factors that significantly influence a student's ability to solve these problems, which is motivation. Motivation represents a state that a living organism experiences, which stimulates behavior, activates it, and directs it toward a specific goal. This state can be inferred from the consequences of goal-directed behavior, culminating in the achievement of the goal, which is the subject of motivation.

Achievement motivation refers to the desire to perform well and succeed in tasks. This desire, as described by McClelland, one of the foremost scholars in this field, is characterized by ambition, enjoyment in competitive situations, a strong desire to work independently, and the ability to confront and solve problems. Such individuals tend to prefer tasks with moderate risks rather than those with minimal or excessive risks (Qatami & Adas, 2002).

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Individuals with high achievement motivation work more diligently than others and achieve more success in various life situations. When compared to individuals of equal intellectual ability but with lower motivation, the former group consistently performs better on tasks involving speed in completing verbal and mathematical tasks, problem-solving, and academic achievement. Furthermore, they tend to make clearer progress in society. High achievers are realistic in seizing opportunities, in contrast to low achievers, who either accept minimal challenges or aim for goals far beyond their abilities (Santrock, 2003).

Given the importance of motivation in educational achievement, we sought to explore the various studies on this topic.

Nabulsi (1986) conducted a study titled "The Relationship between Achievement Motivation Components and Problem-Solving Styles," which revealed a distinctive achievement profile related to thinking styles and problem-solving methods. The study also found significant interaction between problem-solving inputs and thinking style in affecting certain achievement motivation tests (Nabulsi, 1986).

Dormody (1990) conducted a study to determine student motivation for participation and their sense of satisfaction during group problem-solving activities in New York. The results indicated that achievement, belonging, autonomy, and specialization were the key motivators realized during group problem-solving activities.

Al-Tah (1992) examined the impact of achievement motivation and intelligence on problem-solving ability among students in seventh, eighth, and ninth grades in Amman. The results indicated a statistically significant impact of both achievement motivation and intelligence on problem-solving ability.

Cassidy's (2002) study aimed to investigate the relationship between problem-solving styles, achievement motivation, depression, and effectiveness during simulated emergency situations. The results highlighted significant effects between achievement motivation scores and overall problem-solving abilities (Firas George, 2007).

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Shwashra's (2004) study sought to uncover correlations between problem-solving ability and achievement motivation. The results indicated that Pearson's correlation coefficient between the two variables was statistically significant (Shwashra, 2004).

Amara (1981) conducted a study on achievement motivation, which revealed statistically significant differences in achievement motivation between genders in favor of males (Youssef, 2008).

Lee's (1992) study found that females had lower achievement motivation than males, as they believed external factors influenced their success, had weaker beliefs about their abilities, and tended to avoid competitive and ambitious situations. They also did not expect positive reinforcement in case of success (Abdul Hamid, 2003).

Nasrallah (2010) showed significant gender differences in terms of the strength of achievement motivation (Nasrallah, 2010).

Hamri (2012) found gender differences in achievement motivation in favor of males (Hamri, 2012).

Al-Qallhati (2014) revealed differences in tenth-grade students' achievement motivation levels based on gender, with females showing higher motivation (Al-Qallhati, 2014). Similarly, Dowidar (1991) found no statistically significant gender differences in achievement motivation (Abdul Hamid, 2003).

Attia's (2002) study found no significant gender differences in academic achievement motivation (Al-Jubouri, 2013).

Wilk's (2004) study indicated no significant gender differences in achievement motivation (Barakat & Hassan, 2011).

Shalabi (2011) found no significant gender differences in individuals' achievement motivation scores (Shalabi, 2011).

Finally, Qaddouri's (2012) study concluded that there were no statistically significant gender differences in achievement motivation (Qaddouri, 2012).

In conclusion, the importance of achievement motivation in education is evident, as it serves as both an educational goal and a means of achieving specific educational objectives effectively. Motivation influences a student's

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ability to succeed in problem-solving by directing attention to certain activities and enhancing persistence. Since achievement motivation significantly affects educational problem-solving, it determines the appropriate type of thinking for solutions and greatly influences learning. Many studies indicate strong connections between learning and motivation, as motivation has been found to activate learning within the classroom (Abdul Hadi, 2004).

This prompted our interest in researching the relationship between problem-solving ability in mathematics and achievement motivation among fourth-year middle school students. We pose the following questions:

- Is there a correlation between achievement motivation and problem-solving ability in mathematics among the sample?
- Are there gender differences in achievement motivation among the sample?

Study Hypotheses:

- There is a correlation between achievement motivation and problem-solving ability in mathematics among the study sample.
- There are gender differences in achievement motivation among the study sample.

Study Objectives:

- To identify the differences between males and females in terms of achievement motivation.
- To determine the level of achievement motivation among students preparing for the Middle School Certificate.
- To explore the nature of the relationship between achievement motivation and the ability to solve mathematical problems among the study sample.

Study Importance:

- Understanding the impact of achievement motivation on students' ability to solve mathematical problems.
- Highlighting the importance of studying motivation in relation to teaching methods and strategies to develop mechanisms for building and fostering achievement motivation among students.

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- Emphasizing the significance of the age group studied, focusing on adolescence from a biological perspective and the transition from middle to high school academically.

Study Terms:

- **Achievement Motivation:** Defined by Lindzey/Holl as achieving something difficult, controlling and organizing things, performing quickly and independently, overcoming obstacles, achieving a high level of performance, surpassing oneself and competing with others, and increasing self-esteem and effectiveness through successful practice (Osama Kamel Ratib, 2000, p. 48).
 - **Operational Definition:** Achievement motivation refers to a state that stimulates, directs, and energizes behavior, pushing the individual toward a specific goal. Motivation is not a tangible entity, but rather inferred from various behavioral patterns and the individual's internal state. Key indicators of achievement motivation include responsibility, striving for excellence, high ambition, perseverance, awareness of time, and planning for the future.
- **Problem-Solving Ability in Mathematics:** Defined by Fathi Zayat as a form of inferential thinking involving complex processes of transformation, organization, analysis, synthesis, and evaluation of all information related to the problem situation, aimed at generating and addressing the solution (Fathi Zayat, 1984, p. 21-22).
 - **Operational Definition:** It refers to the set of methods and procedures an individual follows to understand and recall information related to the problem situation, from which they begin constructing and evaluating the solution more flexibly and effectively. This is measured by students' achievement scores in mathematics.

Field Procedures of the Study

- **Study Method:**

The study problem determines the appropriate method. Thus, this study adopts the descriptive method as it is most suitable for

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exploring and describing the relationship between problem-solving ability in mathematics and achievement motivation among fourth-year middle school students.

- **Study Sample:**

The first step in any field research is to determine the sample. The research was conducted on a sample of fourth-year middle school students during the 2023/2024 school year, consisting of 82 students, selected through simple random sampling.

- **Study Tools:**

The Achievement Motivation Scale developed by Abdullatif Muhammad Khalifa (2006) was used, and its psychometric properties confirmed its validity for application. In addition, the results of the mathematics test were considered, particularly since Algerian schools rely on the competency-based approach, which uses modern strategies in mathematics, such as problem-solving strategies.

- The Achievement Motivation Scale generally included 50 items, with 10 items dedicated to each component or sub-scale (responsibility, striving for excellence, perseverance, time awareness, future planning).

- **Reliability and Validity:**

Reliability was calculated on a pilot sample of 34 students, with Cronbach's alpha yielding a result of 0.85, confirming the stability of the scale scores.

Validity was assessed using the internal consistency method, demonstrating that the scale is valid and can be applied to the main study.

- **Statistical Methods:**

The current study utilized the following statistical methods: mean, standard deviation, and Pearson correlation coefficient.

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5. Presentation and Discussion of Results:

5.1 First Hypothesis:

The first hypothesis states that there is a correlation between the ability to solve mathematical problems and achievement motivation among fourth-year middle school students. To verify this, Pearson's correlation coefficient was used, and the results are shown in Table 1 below:

Table 1: Results of applying Pearson's correlation coefficient to study the relationship between problem-solving ability and achievement motivation among the sample.

Variables	Sample Size	Pearson Value	Decision (Significant, Not Significant)
Relationship between X and Y	82	0.31	Significant at 0.01

From Table 1, we observe that Pearson's correlation coefficient is 0.31, which is a moderate positive value. This means that the correlation between problem-solving ability and achievement motivation is positive. In other words, as achievement motivation increases among fourth-year middle school students, their ability to solve mathematical problems also increases, and vice versa. Moreover, the result of this correlation is statistically significant at the 0.01 level, leading us to accept the research hypothesis, which states that there is a statistically significant correlation between problem-solving ability in mathematics and achievement motivation among fourth-year middle school students.

This positive relationship can be interpreted by the fact that achievement motivation serves as a means to effectively achieve specific educational goals. It is one of the key factors that determine a student's ability to succeed in solving problems. Achievement motivation is closely related to the student's tendencies, directing their attention to some activities over others. It is also linked to their needs, making certain stimuli reinforcing and influencing their behavior, driving them to persevere and work effectively.

The reason for this positive correlation is that achievement motivation is one of the factors that affect the student's level of problem-solving ability.

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It determines the type of appropriate thinking for solutions and motivates the student to choose the best methods and experiences in various learning situations.

This finding is supported by a study conducted by Al-Tah (1992), which showed that both achievement motivation and intelligence have a statistically significant effect on problem-solving ability. Achievement motivation manifests as the desire to perform well and succeed in tasks. McClelland, one of the pioneers in this field, described this desire as characterized by ambition, enjoyment of competitive situations, a strong desire for independence, facing challenges and solving them, and preferring tasks that involve moderate risk over those with low or very high risk (Qatami & Adas, 2002).

Achievement motivation can place a person in high levels of performance and drive them to solve the problems they face. However, consistently working with perseverance towards excellence and superiority alone will not guarantee success. Those who seek success in achievement situations are highly adaptable and resilient in difficult circumstances, drawing strength from their self-confidence and unwavering willpower.

Furthermore, achievement motivation requires strong external support from the surrounding environment to stimulate appropriate behavior, encourage individuals to solve their problems, and determine the quality of the work and the effectiveness of the problem-solving process based on the individual's persistence in achieving success or reaching any achievable goal.

5.2 Second Hypothesis:

The second hypothesis states that there are statistically significant differences in achievement motivation between males and females. Through the study, and by applying the t-test to examine the differences between the two groups, the results were obtained as shown in Table 2 below:

Table 2: Results of applying the t-test to examine the significance of differences in the average achievement motivation scores between males and females in the sample.

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Variable	Statistical Data
	Sample Size
Females	46
Males	36

From Table 2, it is clear that there are no statistically significant differences between the genders, as the calculated t value is -2.080 , which is not statistically significant at the 0.01 level. The mean score for females is 170.48 with a standard deviation of 2.87 , while the mean score for males is 160.58 with a standard deviation of 3.93 .

This indicates that the achievement motivation among the study sample is similar regardless of gender. The students' preference for challenges, curiosity, and desire for independent mastery does not differ based on gender, but rather based on their academic achievement. All the students in the sample came from similar educational, social, and economic backgrounds, resulting in relatively similar levels of motivation.

This result can also be attributed to the availability of opportunities for success for students of both genders and the role of the school and its educational, social, and psychological structures in establishing social justice and equality in knowledge and learning without discrimination or exclusion. It can also be linked to the role of parents in fostering a sense of equality in upbringing between sons and daughters and the family's role in raising a generation capable of facing various forms of deviation, extremism, and selfishness, which have become prevalent in different social circles.

The absence of discrimination between males and females creates psychological comfort, as both have equal opportunities for success, which in turn enhances their motivation for achievement. This fosters a positive image of school and classroom management, which plays a significant role in boosting students' motivation along with other important factors. As a result, the interaction between males and females takes place naturally both inside and outside the classroom.

In this context, Dweidar's (1991) study found no statistically significant differences in achievement motivation between genders. Similarly, Atiya's

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(2002) study revealed no statistically significant differences in academic achievement motivation between males and females, as did the studies of Wilk (2004), Shalabi (2011), and Kadouri (2012), all of which concluded that there were no statistically significant differences in achievement motivation levels attributed to gender.

6. Conclusion:

The results of this study indicated a correlation between problem-solving ability and achievement motivation among fourth-year middle school students, with no differences between males and females, due to several reasons.

This highlights the importance of achievement motivation and problem-solving ability in the educational field and their role in supporting and enhancing the learning process, helping students achieve their goals. Putting students in challenging situations that disrupt their progress helps increase their motivation to achieve and reach their objectives.

Additionally, efforts to develop students' achievement motivation by providing the right environment and relevant experiences, not just in learning but in life in general, help them gain the determination to overcome obstacles and, consequently, improve their problem-solving abilities.

Based on the above, we offer the following suggestions:

- Conduct studies aimed at developing programs to raise students' awareness of how to utilize their energies at different educational levels.
- Guide students with low motivation and introduce them to methods of increasing and stimulating it.
- Develop programs to enhance students' motivation for achievement.
- Implement cumulative student records to track the progression of their achievement motivation and understand each student's nature and needs for boosting motivation.

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