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Mathematical Intelligence as a Diagnostic Framework for Academic Excellence: A Field Study on High-Achieving Fourth-Year Middle School Students in Bouira, Algeria

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Keywords Mathematical intelligence; academic excellence; middle school students; diagnostic approaches; educational assessment; Bouira; Algeria.

Abstract

This study investigates the role of mathematical intelligence as an approach to diagnosing academic excellence among high-achieving fourth-year middle school students in Bouira, Algeria. While academic achievement in mathematics is often considered an indicator of excellence, the study critically examines whether it adequately reflects higher-order cognitive abilities associated with mathematical intelligence. Conducted during the 2024/2025 academic year, the research relied on a purposive sample of 82 high-achieving students, including 45 female students enrolled in local middle schools.

Adopting a descriptive research design, the study employed the Mathematical Intelligence Test developed by Senoussi Boumediene and compared its outcomes with student performance on achievement tests across the first and second terms.

The findings reveal that most high-achieving students demonstrate an average level of mathematical intelligence, and that the correlation between mathematical intelligence and both overall academic achievement and achievement in mathematics remains moderate to weak. These results suggest that high academic performance does not necessarily correspond to excellence in mathematical intelligence.

The novelty of this research lies in reframing academic excellence assessment by moving beyond grades to include cognitive diagnostic tools. The study contributes to the literature by highlighting the necessity of adopting multidimensional frameworks for identifying excellence, thereby informing both educational policy and classroom practices. It recommends the revision of achievement tests to capture diverse aspects of intelligence and the integration of multiple diagnostic approaches to better identify and nurture exceptional talent.

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Research of Problem:

The concept of logical-mathematical intelligence occupies a central position in the framework of the theory of multiple intelligences, given its association with a field that has long been considered an indicator of a person's overall intellectual ability, namely, mathematics. It is also linked to logical thinking, problem-solving, and the ability to deal with different mathematical operations smoothly and efficiently.

In reality, there is a pressing need to direct the mathematical training of elite learners to prepare them for key roles requiring competence in mathematics, particularly with the emergence of modern fields such as artificial intelligence, computer science, and other disciplines derived from mathematics. This necessity calls for precision in selecting these learners, and for constructing methods of selection, training programs, and subsequent support.

Anyone familiar with the field of assessment in schools in general, and Algerian schools in particular, recognizes their consistent reliance on achievement tests. These are generally based on curriculum-related content and vary in their lack of key test construction features, especially those of high importance such as discriminatory power, difficulty and ease levels, and structural gradation. Additionally, the obtained results are often influenced by non-pedagogical factors.

High-achieving students are not exempt from this situation, despite having demonstrated clear excellence according to the prevailing evaluation standards.

When considering the relationship between academic excellences in general, and in mathematics specifically, within the context of previous studies, we find that most research has identified either an explicit or implicit correlation between the two variables. For instance, the study of (Wai et al., 2009) indicated that mathematical skills can predict future achievement in mathematics, technology, and engineering.

Similarly, the study of (Al-Otaibi, 2018) revealed a correlation between mathematical intelligence and achievement in mathematics and other sciences. Moreover, (Bakhti, 2012) showed that high levels of mathematical thinking are inversely related to difficulties in learning mathematics.

A close examination of these findings shows that they largely consider mathematical intelligence as a positive determinant and predictor of academic performance. However, on the other hand, when scrutinizing the study of (Abd Al-Razzaq Hind, 2012), a survey aimed at identifying the level of logical-mathematical intelligence among mathematics students who are theoretically expected to possess a highly advanced level of this ability, it was found that they actually demonstrated a below-acceptable level of logical-mathematical intelligence.

Compared with studies that sought to determine the role of mathematical intelligence in academic performance, this latter study provided a different perspective: it questioned whether academic achievement, based on achievement tests (upon which students are directed toward mathematics-related fields), is sufficient to determine the level of mathematical intelligence.

From this standpoint, the current study emerged, focusing on a sample of high-achieving fourth-year middle school students. This stage represents a critical juncture, where the academic and functional profile of students begins to emerge through their interests and abilities, as reflected in their academic performance, without necessarily considering their true abilities, particularly when decisions about their educational orientation are made.

In other words, this study seeks to examine the extent to which general academic performance and performance in mathematics can predict the level of mathematical intelligence among high-achieving fourth-year middle school students, and to consider it as an alternative approach to diagnosing mathematical intelligence.

Accordingly, the following research questions are raised:

Research Questions

1. What is the reality of mathematical intelligence among excellent fourth-year middle school students?
2. Is there a statistically significant correlation between the level of mathematical intelligence and general academic achievement among exllent fourth-year middle school students?
3. Is there a statistically significant correlation between the level of mathematical intelligence and achievement in mathematics among exellent fourth-year middle school students?

Research Hypotheses:

As provisional answers to the previously stated questions, we propose the following hypotheses:

1. Most exellent fourth-year middle school students possess an average level of mathematical intelligence.
2. There is a statistically significant correlation between the level of mathematical intelligence and the level of general academic achievement among exellent fourth-year middle school students.
3. There is a statistically significant correlation between the level of mathematical intelligence and achievement in mathematics among exellent fourth-year middle school students.

Study Significance:

The importance of this study lies in its focus on diagnosing one of the most important types of intelligence according to the theory of multiple intelligences, mathematical intelligence, among a group of students entering a stage that largely determines their future academic trajectory. A fourth-year middle school student is directed to a specific stream based on their overall grade point average and profile, in addition to their personal preferences. One of these possible pathways is the exact sciences, which serve as a prelude to pursuing specializations that require high levels of mathematical intelligence in the future.

It is well known that the achievement tests adopted in schools do not always meet the criteria for sound test construction, such as comprehensiveness, gradation, discriminatory power, and appropriate levels of difficulty and ease to determine the required level. Consequently, they may not qualify as accurate diagnostic tools for academic excellence in mathematics. Furthermore, the results may be influenced by non-pedagogical factors such as social relations and cheating. Accordingly, this study seeks to explore the extent to which mathematics achievement scores can reveal the level of mathematical intelligence among fourth-year middle school students, and whether they may serve as a substitute for it.

Study Objectives:

As is well established in the field of scientific research, the significance of a study is measured by the objectives it seeks to achieve. The objectives of this study are twofold: first, to diagnose the reality of mathematical intelligence among high-achieving fourth-year middle school students; and second, to determine the extent to which mathematics achievement tests can predict the level of mathematical intelligence among high-achieving students in general, and among those excelling in mathematics in particular.

Definition of Concepts:

This study is based on two key concepts: mathematical intelligence and academic excellence, which will be defined as follows:

1. **Mathematical Intelligence:**

Mathematical intelligence is considered one of the most important types of intelligence identified by Gardner in his theory of multiple intelligences. It refers to the ability to use numbers effectively and to solve numerical problems and puzzles. This type of intelligence is manifested in the ability to think scientifically, perceive patterns and logical relationships such as causal links, and includes the ability to anticipate and predict based on specific data, as well as skills of exploration and inquiry into logical causes (Al-Najjar & Al-Zayat, 2010, p. 25).

Mathematical intelligence is also defined as the capacity to handle numbers and solve problems using logic. It requires significant observational and analytical skills in order to formulate hypotheses.

Source:https://www.doctissimo.fr/psychologie/intelligence/les-8-formes-dintelligence/intelligence-logico-mathematique

In this study, mathematical intelligence is measured by the score obtained by the high-achieving fourth-year middle school student on the Mathematical Intelligence Scale developed by Senoussi Boumediene.

2. **Academic Excellence:**

Academic excellence is a fluid concept whose indicators have not been precisely defined by researchers. Some have relied on intelligence scores to identify gifted students, while others have used outstanding academic achievement to describe them. This is due to the fact that a student may excel academically without excelling intellectually, artistically, or socially.In other words, excellence may occur in one field but not in another, or in one subject but not in others.

We present here some definitions of academic excellence:
The U.S. Office of Education defines gifted students as those who demonstrate high abilities, are capable of effective performance, and show academic, intellectual, creative, or productive thinking skills, as well as leadership, visual, or performance talents (Al-Sayyid Abu Hashem Hassan, 2013, p. 18).

According to (Jarwan, p. 4), gifted children are those who show evidence of high performance capabilities in the areas of general intellectual ability, creative thinking, leadership, specific academic aptitude, and visual or performance arts.

The most recent definition of academic excellence regards it as a multidimensional construct that goes beyond high academic performance to include the development of individual and collective competencies necessary for success in an interconnected and ever-changing world. Academic excellence is viewed as a dynamic and continuous process that requires a variety of capacities, including deep learning, self-efficacy, and cognitive flexibility (Claxton, Getz, Dillon, & K., 2017).

In this study, academic excellence is defined as achieving an average score equal to or above 17.5/20, whether in the overall average or in the mathematics exam, based on the results of the first semester of the 2024/2025 academic year.

Theoretical Background and Previous Studies:

For a long period of time, the dominant idea was that intelligence is singular, and intelligence scales were developed on this basis. However, observations of reality revealed performance differences among individuals in different domains: one may demonstrate social superiority, another visual superiority, and a third mathematical

superiority. Accordingly, Gardner's theory of multiple intelligences emerged, which views intelligence as multiple rather than singular.

Mathematical intelligence is considered one of the intelligences highlighted by the theory of multiple intelligences. It develops and evolves under the influence of three factors, as it represents a joint product of genetic factors and life experience. A child may carry genes that strongly support the emergence of mathematical intelligence, but if their life experience does not stimulate and nurture this intelligence, the genes alone will not operate effectively in the absence of experiential support (Noha Imam Hamed, 2022). When speaking about the role of experience in the development of mathematical intelligence, we refer to training aimed at enhancing this type of intelligence. The Soroban technique (Japanese mental arithmetic) is a clear example of the role of training in this field.

The indicators of mathematical intelligence can be summarized as follows:

- **Inductive thinking ability:** This refers to the ability to identify the relationship between parts, their causes, and components in order to arrive at the overall picture in any given problem. As is known, induction is the process of thinking that begins from the part and leads to the whole.
- **Deductive thinking ability:** Deductive thinking is the ability to reach conclusions through prior knowledge, analyzing that knowledge, and providing logical explanations. It is a mental process in which the individual moves from the general to the particular, descending from theory to hypothesis to field data, thereby forming new information that contributes to solving a problem in a highly logical way (Hiba Aqeel Khudair, 2024).
- **Ability to perform mathematical operations:** This refers to an individual's ability to carry out mathematical operations with accuracy, efficiency, and speed, as well as the ability to deal with abstract concepts and symbols.
- **Problem-solving ability:** This is a cognitive process in which an individual uses previously acquired knowledge and skills to respond to the requirements of a familiar situation. The response consists of taking an action aimed at resolving the contradiction, ambiguity, or obscurity contained in the situation (Jarwan, Fathi, 1999, p. 99).

The variable of mathematical intelligence has been addressed in numerous studies, although most of these studies focused on measuring it. In this study, however, we focus on the studies that explored the relationship between mathematical intelligence and different types of performance in various fields, as well as those that aimed to highlight the prevalence of mathematical intelligence in different statistical populations.

Since the relationship between mathematical intelligence and academic achievement in general, and performance in specific subjects in particular, has been a subject of great interest in educational research, particularly with the aim of understanding how mathematical intelligence, with its capacities for reasoning, analysis, and solving mathematical and logical problems, influences performance in various areas of school life, several studies have highlighted this relationship.

In this regard, the longitudinal study of (Wai et al., 2009) showed that mathematical abilities emerging at an early age can strongly predict academic achievement in science, technology, engineering, and mathematics. Similarly, (Al-Otaibi, 2018) indicated a statistically significant relationship between mathematical intelligence and academic achievement in mathematics and science among secondary school students in Saudi Arabia.

The study by (Al-Najjar, 2020) demonstrated that the development of logical-mathematical intelligence among learners contributes to improving their performance in subjects that require critical thinking, problem-solving, and cognitive processes associated with logical-mathematical intelligence. In the same context, (Geary, 2010) found that the ability to process quantitative information and abstract thinking, both indicators of mathematical intelligence, play a crucial role in acquiring scientific and mathematical knowledge.

Furthermore, (Johnson & Smith, 2022) showed that students with logical-mathematical intelligence possess greater ability to understand complex concepts in computer science and to transform them into effective programming solutions. In another context, (Al-Khouli, 2021) emphasized the importance of providing learning environments that stimulate the development of logical-mathematical intelligence during the preschool stage, as this helps better prepare the child for elementary school.

As for the study by Bakhti (2022), which included 30 male and female primary school pupils, it indicated the existence of an inverse correlation between mathematical thinking and learning difficulties. In the same year, the study by Abd al-Kadhim Muhammad Ibtisam (2022), entitled *Productive Thinking and Its Relationship with Logical-Mathematical Intelligence among Fourth-Year Scientific Stream Female Students in Mathematics*, pointed to a statistically significant correlation between mathematical intelligence and productive thinking.

Meanwhile, the study by Abd al-Razzaq Naji Hind (2022), conducted on a sample of 200 male and female students from the Mathematics Department, found that students possess mathematical intelligence but at a level below the acceptable threshold. It further indicated the presence of a statistically significant correlation between the level of mathematical thinking and academic performance.

Commentary on Previous Studies:

A review of the research field related to mathematical intelligence reveals a scarcity of studies on the subject, particularly in Algeria, especially those focusing on the predictive capacity of achievement tests in general, and achievement in mathematics specifically, in relation to the level of mathematical intelligence among fourth-year middle school pupils. Theoretically, it is assumed that a student who excels academically, or particularly in mathematics, must possess at least a good level of this ability when assessed using standardized tests measuring mathematical intelligence. If results indicate otherwise, this suggests that current achievement tests are not an adequate substitute for diagnosing the level of mathematical intelligence.

Study Method:

Since the aim of this study is to investigate the extent to which fourth-year middle school pupils possess mathematical intelligence, as well as to examine the nature of the relationship between this type of intelligence and overall academic achievement, in addition to achievement in mathematics among the same group (high-achieving fourth-year middle school pupils), the adopted method is the descriptive correlational method.

Study Sample:

The study population consists of high-achieving fourth-year middle school pupils enrolled in various middle schools in the city of Bouira during the 2024/2025 academic year. The sample included 82 pupils, 37 males and 45 females.

The following table illustrates the characteristics of the research sample:

Table 1. Characteristics of the Research Sample

Educational Institution	Number of High-Achieving Pupils	Gender	
		Male	Female

Gouizi Saïd Middle School	15	8	7
Hmiltoush Ali Middle School	13	8	6
Getaf Belkacem Middle School	10	7	3
Debaïssi Middle School	10	2	8
Akou Mohand Amziane Middle Sch.	11	5	6
140 Housing Middle School	9	4	5
Aït Saïd Amr Middle School	13	3	10
Total	**82**	**37**	**45**

Data Collection Tools:

In this study, we employed the Mathematical Intelligence Test developed by Sanoussi Boumediene in 2024, designed to measure mathematical intelligence among fourth-year middle school pupils. Details of this test will be presented later. As for academic achievement, including students' grades in mathematics, we relied on report cards of the sample pupils for the first semester of the 2024/2025 academic year.

Regarding the Mathematical Intelligence Test, it consists of 23 exercises (activities) distributed across four dimensions, as shown in the following table:

Table 2. Activities of Sanoussi's Mathematical Intelligence Test Distributed by Dimensions

Dimensions of the Mathematical Intelligence Test	Activity Numbers
Ability for Inductive Thinking	1, 2, 3, 4, 5, 6
Ability for Deductive Thinking	7, 8, 9, 10, 11
Ability to Perform Arithmetic Operations	12, 13, 14, 15, 16, 17, 18, 19
Ability to Solve Problems	20, 21, 22, 23

The internal consistency reliability of Sanoussi's Mathematical Intelligence Test (2024) ranged between 0.73 and 0.88 across the scale's dimensions, which is considered an acceptable level of validity.

As for the criterion-related validity, it reached 0.43, which is an acceptable level compared to the criterion used, namely the mathematics grades of the research sample. Moreover, the test items demonstrated high discriminative power, whether at the level of activities, dimensions, or the overall test score (Sanoussi Boumediene, 2024).

With regard to the reliability of the Mathematical Intelligence Test, it amounted to 0.81 using the Kuder–Richardson method and 0.76 using the split-half method, both of which are highly acceptable levels of reliability.

As for the scoring method of the test, one point is awarded for each correct activity, while zero points are given for each incorrect one. Accordingly, the lowest possible score a pupil can obtain is zero, and the highest is 23. The following table illustrates the categories of mathematical intelligence according to Sanoussi's Mathematical Intelligence Test (2024).

Table 3. Levels of Mathematical Intelligence According to Sanoussi Boumediene's Mathematical Intelligence Test

Category	Level of Mathematical Intelligence
0 to 8	Low Mathematical Intelligence
9 to 13	Moderate Mathematical Intelligence
14 to 23	High Mathematical Intelligence

Statistical Techniques:

Since the objectives of the study ranged from identifying the reality of mathematical intelligence among fourth-year middle school pupils, in addition to examining the relationship of this intelligence with overall academic achievement as well as achievement in mathematics, the statistical techniques employed included percentages and Pearson's correlation coefficient.

Presentation, Analysis, and Discussion of Results:

The following presents the results obtained through data processing, following the sequence of hypotheses.

1/ Presentation, Analysis, and Discussion of Results Related to the First Hypothesis, which posits that most high-achieving fourth-year middle school pupils possess a moderate level of mathematical intelligence.

Table 4. Results of the Statistical Analysis Related to the First Hypothesis

Level of Mathematical Intelligence	Number of Sample Members	Percentage
0 to 8	5	16.10%
9 to 13	57	69.51%
14 to 23	20	24.39%
Total	82	100%

The table above shows that most high-achieving fourth-year middle school pupils possess a moderate level of mathematical intelligence, with a percentage of 69.51%, representing the category ranging between 9 and 13 points. In second place, 24.39% of the sample exhibited high mathematical intelligence, ranging between 14 and 23 points. The weakest proportion in the table corresponds to high-achieving pupils with a low level of mathematical intelligence, estimated at 16.10% of the research sample.Based on the data presented in the previous table, it can be stated that the first hypothesis has been confirmed.

From a qualitative perspective, the quantitative results regarding the distribution of mathematical intelligence scores within the studied sample (N = 82) offer important insights when interpreted in the context of related research literature. The clear dominance of the second category (scores 9–13), comprising approximately 69.51% of individuals, indicates that the prevailing pattern within this sample is the possession of a *moderate* level of mathematical intelligence. This observation is consistent with the general trend highlighted in studies such as Al-Otaibi (2018) and Abd al-Razzaq Naji Hind (2022), which report that levels of mathematical intelligence are correlated with performance and academic success.

This suggests that an acceptable or moderate level of mathematical intelligence may be sufficient to meet the academic requirements for achieving ordinary scholastic excellence, as assessed by non-standardized achievement tests influenced to some extent by the social and cultural framework prevailing in the school environment.

However, this moderate level of mathematical intelligence is not sufficient to achieve the kind of exceptional academic excellence measured by standardized tests, such as various intelligence assessments or standardized achievement tests like those used in Mathematics Olympiad competitions (Wai et al., 2009).

2/ Presentation, Analysis, and Discussion of the Results of the Second Hypothesis, which states that there is a correlational relationship between the level of mathematical intelligence and the level of overall academic achievement among high-achieving fourth-year middle school pupils.

Table 5. Results of the Statistical Analysis Related to the Second Hypothesis

Variables	Sample Size	Significance Level	Pearson's Correlation Coefficient	Statistical Significance
Mathematical Intelligence	82	0.01	0.49	Existence of a Moderate Positive Correlation
Academic Achievement				

From the statistical analysis results in the above table, it is observed that the correlation coefficient was estimated at 0.49 at the significance level of 0.01. This value is very close to the mid-range of the correlation coefficient (0.5), which indicates the presence of a clear, moderate, positive linear relationship between the two variables. This leads us to accept the second research hypothesis, which posits a statistically significant correlational relationship between the level of mathematical intelligence and the level of academic excellence among fourth-year middle school pupils.

The results of the present study, which pointed to a moderate positive relationship between mathematical intelligence and the level of academic achievement among the research sample, are consistent with the general direction of previous studies. These studies have found that mathematical intelligence, with its various dimensions (inductive thinking, deductive thinking, problem-solving, and computational operations), significantly contributes to raising the level of academic achievement in general (Wai et al., 2009; Geary, 2010; Al-Otaibi, 2018; Al-Najjar, 2020). This is particularly true considering that the academic achievement adopted in this study partly consists of grades in scientific subjects (mathematics, science, physics), which usually require this type of skill.

The findings of the present study are also supported by other studies that have repeatedly confirmed the positive role of mathematical and logical abilities in predicting academic performance (Al-Kadhim, 2022; Al-Razzaq, 2022).

It should be noted here that these studies have considered mathematical intelligence as a predictor of academic performance and not the other way around. That is, the higher the level of mathematical intelligence, the higher the academic performance is expected to be.

However, the reverse is not always true. Despite the apparent agreement between the results of the present study and those of previous research, it is important to note that the value of **0.49** indicates only a moderate positive relationship, which is not sufficient to consider academic achievement as a predictor of mathematical intelligence or as a substitute for assessing it. Other factors must also be taken into account in determining a pupil's achievement level, including motivation, the objectivity of achievement tests, and the influence of social and relational factors.

3/ Presentation, Analysis, and Discussion of the Results of the Third Hypothesis, which states that there is a correlational relationship between the level of mathematical intelligence and the level of academic achievement in mathematics among high-achieving fourth-year middle school pupils.

Table 6. Results of the Statistical Analysis Related to the Third Hypothesis

Variables	Sample Size	Significance Level	Pearson's Correlation Coefficient	Statistical Significance
Mathematical Intelligence	82	0.01	0.40	Existence of a Moderate Positive Correlation
Achievement in Mathematics				

From the statistical analysis results in the table above, it is observed that the correlation coefficient was estimated at 0.40 at the significance level of 0.01. This value is very close to the mid-range of the correlation coefficient (0.5), which indicates the presence of a moderate positive relationship between the two variables. This leads us to accept the third research hypothesis, which posits a statistically significant correlational relationship between the level of mathematical intelligence and the level of academic excellence in mathematics among high-achieving fourth-year middle school pupils.

Although a correlation value of 0.40 indicates the existence of a relationship between mathematical intelligence and achievement in mathematics, it must be noted that this does not exceed the limits of a moderate relationship. It explains only part of the actual relationship between the two variables. This means that other factors must be taken into consideration when analyzing this result, such as learning motivation, learning strategies, various forms of support, and teaching methods.

However, when placing this result within the framework of the scientific literature in the field, it becomes clear that it once again confirms the vision of the Theory of Multiple Intelligences presented by Gardner, who viewed mathematical intelligence as the ability to use numbers effectively, to think logically, to analyze problems rationally, and to perform complex mathematical operations (Gardner, H., 1999). Naturally, the subject of mathematics fundamentally depends on these abilities, which are considered core components of logical–mathematical intelligence.

In the context of previous studies, the findings of the present study are clearly consistent with those of Akkus and Killi (2015), conducted on second-grade students, which concluded that there is a statistically significant correlational relationship between logical–mathematical intelligence and students' mathematical abilities.

In the same context, the study by Yildirim et al. (2011) indicated that teaching based on the Theory of Multiple Intelligences, which takes into account the development of logical–mathematical intelligence, has a positive effect on students' achievement in the topic of probability. Within the same framework, the study of Wai et al. (2009) supported the current finding, as it showed that mathematical abilities manifested at an early age can strongly predict academic achievements in the fields of science, technology, engineering, and mathematics. Similarly, the study of Al-Otaibi (2018) indicated a clear correlational relationship between mathematical intelligence and achievement in mathematics among high school students in Saudi Arabia. Furthermore, Al-Najjar (2020) demonstrated that the development of mathematical intelligence among learners contributes to improving their performance in subjects requiring critical thinking, problem-solving, and cognitive processes associated with logical–mathematical intelligence.

In general, the scientific literature addressing the relationship between mathematical intelligence and achievement in mathematics and similar subjects has largely confirmed the existence of a correlation between the two aspects. This is consistent with the findings of the present study. However, it must be emphasized that the result of this study did not exceed the moderate level, which means that academic achievement in mathematics cannot be considered a strong indicator of a high level of mathematical intelligence. When looking at individual cases, we observed situations in which students demonstrated high academic performance in mathematics but only an acceptable level on the mathematical intelligence test.

Conclusion:

The idea for this study stemmed from the growing demand for high-achieving individuals across different fields, and particularly in mathematics on the one hand, and from the reliance on non-standardized achievement tests as the sole tool for diagnosing general academic excellence, including excellence in mathematics, on the other. Based on such diagnoses, which may be influenced by many non-pedagogical factors, students are directed toward specializations that require high competence in mathematics and a distinguished level of related abilities, such as logical thinking, problem-solving, and the ability to handle mathematical operations with ease and skill, in preparation for taking on specific roles in the future, particularly in mathematics, computer science, and artificial intelligence.

Based on previous studies that have agreed on the existence of a correlation between the level of mathematical intelligence and school performance in general, and on considering mathematical intelligence as an important determinant of academic excellence in mathematics and sciences overall, without carefully considering the actual value of the correlation, which in most cases did not exceed a moderate level, as well as some studies that pointed to a lower-than-expected level of mathematical intelligence among mathematics students, the present study aimed to examine the extent to which general academic excellence and achievement in mathematics could be considered indicators of a high level of mathematical intelligence among fourth-year middle school pupils.

This was done by formulating a set of hypotheses suggesting that high-achieving fourth-year middle school pupils possess an average level of mathematical intelligence, in addition to exploring the correlational relationship between mathematical intelligence, general academic achievement, and achievement in mathematics.

In other words, if previous studies have proven that pupils excelling in mathematical intelligence have very high chances of excelling academically, does this necessarily mean that pupils who excel academically are also high achievers in the domain of mathematical intelligence?

The present study concluded that most high-achieving fourth-year middle school pupils possess only an average level of mathematical intelligence, while only a few of them have a high level of this type of intelligence.In the same

vein, the relationship was found to be below average between mathematical intelligence and overall academic achievement, as well as achievement in mathematics.

In reality, these hypotheses reinforce one another. That is, pupils classified as high-achieving based on non-standardized achievement tests are not necessarily high achievers in mathematical intelligence. Consequently, it can be argued that academic excellence is not a sufficient indicator of whether a high-achieving pupil possesses at least a good level of mathematical intelligence. Therefore, reliance solely on achievement tests to diagnose the level of mathematical intelligence is insufficient for guiding high-achieving pupils toward mathematics and related fields without resorting to more precise diagnostic tools.

Based on the results obtained from this study, which revealed that general academic achievement and achievement in mathematics in particular are not sufficient for diagnosing the level of mathematical intelligence among high-achieving pupils, two main recommendations can be made:

1. The upgrading of achievement tests to the level of standardized achievement tests with the full psychometric properties of reliable assessments.
2. The adoption of other approaches to diagnose the level of mathematical intelligence, such as the use of standardized psychological tests specifically designed for this domain.

Novelty of the Study

This study introduces mathematical intelligence as a diagnostic framework rather than relying solely on achievement scores. Unlike traditional studies that equate high performance with excellence, this research demonstrates that mathematical intelligence and achievement are distinct constructs, highlighting the limitations of conventional assessment systems.

Methodology

- Design: Descriptive, quantitative field study.
- Sample: 82 purposively selected high-achieving fourth-year middle school students in Bouira, including 45 females.
- Instruments:
  - Mathematical Intelligence Test by Senoussi Boumediene.
  - School achievement test scores (first and second term).
- Procedure: Data collection took place during the 2024/2025 academic year in collaboration with participating schools.
- Analysis: Correlation and descriptive statistics were employed to examine the relationship between mathematical intelligence and academic achievement.

Findings

The study produced the following key results:

1. Average Level of Mathematical Intelligence
   - Despite being classified as high-achieving students, the majority of participants exhibited only an average level of mathematical intelligence on the Senoussi Boumediene test.
   - This indicates that excelling in school assessments does not always equate to superior mathematical cognitive ability.

2. Correlation with General Academic Achievement
   - Statistical analysis revealed a moderate to weak positive correlation between mathematical intelligence and

general academic achievement.

- This suggests that while mathematical intelligence may contribute to broader academic success, it is not a decisive factor.

3. Correlation with Achievement in Mathematics

- A similar moderate to weak correlation was observed between mathematical intelligence and performance in mathematics-specific subjects.
- Some students who scored highly in mathematics achievement tests did not necessarily display advanced mathematical intelligence, and vice versa.

4. Implications for Educational Assessment

- The findings confirm that academic excellence cannot be diagnosed solely through achievement scores.
- Relying exclusively on term results risks overlooking students with latent or underdeveloped mathematical intelligence.

Ethical Considerations

The study adhered to the ethical standards of research involving human participants. Informed consent was obtained from both students and their guardians. Anonymity and confidentiality of the participants' data were ensured. The research followed the ethical guidelines of Akli Mohand Oulhadj University, Bouira.

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Conflict of Interest

The author declares no conflict of interest regarding the publication of this research.

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