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Achievement In Arabic Language And Mathematics Subjects For Primary School Students In Relation To The Logical-Mathematical Intelligence And Spatial Visual Intelligence

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Abstract:

The aim of this study was to investigate the relationship between two types of multiple intelligences, namely logical-mathematical intelligence and spatial-visual intelligence, and academic achievement in the subjects of Arabic language and mathematics among primary school students. The descriptive method was used, relying on the Arabic version of the Gardner's logical-mathematical and spatial-visual intelligence scales for school-age children, translated by Mohammed (2006), as well as the results of achievement tests for the relevant subjects in the third term of the academic year 2021/2022. The study sample included 72 students from Ghania Ahmed and Abu Bakr Al-Siddiq schools in Béchar, Wadi El-Abiod, Algeria. After data analysis using the Pearson statistical method, the study results showed a statistically significant relationship between logical-mathematical intelligence and academic achievement in the subjects of Arabic language and mathematics. However, there was no statistically significant relationship between spatial-visual intelligence and academic achievement in the subjects of Arabic language and mathematics.

Keywords: multiple intelligences, logical-mathematical intelligence, spatial-visual intelligence, academic achievement, academic subjects.

Introduction:

The importance of intelligence becomes evident in most of the behaviors exhibited by individuals during their constant interaction with their environment. This importance becomes clearer and more significant throughout various stages of individual development, across cognitive, skill-based, and interactive domains. This explains the enduring and renewed interest of educators in individuals who display signs of giftedness and intelligence, considering that intelligent individuals are reliable projects of success that can be relied upon to carry the torch of knowledge and understanding. This, in turn, contributes to the prosperity and progress of nations. Consequently, the process of their academic achievement is easier and faster compared to those who demonstrate a limited level of intelligence.

The esteemed position of intelligence in the educational process has captured the special attention of psychologists and educators, distinguishing it from other cognitive abilities. Consequently, various definitions and theories have emerged to explain intelligence. According to Freeman, these can be classified into three types. The first type views intelligence as an organic ability attributed to genetics and the organic constitution of the individual. The second type focuses on the social and environmental aspects and the impact of various interactions on

intelligence. The third type evaluates intelligence through psychological and behavioral manifestations (Zaidan & El-Samalouty, 1994). However, an observer of these types recognizes that while they complement each other in practice, intelligence has long been considered a single ability with relatively varying levels among individuals. It wasn't until the emergence of the theory of multiple intelligences that a revolution occurred in the field of modern educational practice. This theory, introduced by Howard Gardner in 1983 in his book "Frames of Mind," rejected the notion of intelligence as a single ability and argued that learners' abilities are not limited to linguistic and logical-mathematical intelligence alone.

Supporting Gardner's theory, which completely rejects the idea that intelligence is a singular ability, are the observations that repeatedly caught his attention regarding individuals who possess exceptional intelligence in certain domains but do not achieve high scores on intelligence tests. It was also observed that damage to specific parts of the brain affects cognitive abilities other than intelligence, emphasizing the difficulty of fully regulating and identifying the separate abilities encompassed by intelligence. However, Gardner initially identified the main abilities of intelligence, specifying seven types of intelligence (Al-Zaghloul, 2012). Thus, this theory has two main aspects that Gardner reached through these experiences. The first aspect is that intelligence is not a unified and homogeneous mental ability, and therefore, there is no single intelligence. Instead, there are several types of intelligence, each forming its own independent pattern. The second aspect is that these types of intelligence interact with each other to perform different tasks. Facing a problem requires the collaboration of multiple intelligences to solve it (Taha, 2006).

These intelligences mobilize within an individual when they encounter challenges in search of solutions. For school-age children, their primary concern in these challenges is how to learn more and achieve higher academic performance. Many people view academic achievement as the outcome of educational efforts. Therefore, raising the level of academic achievement among learners is one of the noblest goals pursued by educational practitioners. It is not as simple as some may perceive it to be. Academic achievement is more than just the grades obtained in academic assessments, and it is not solely determined by the amount of studying. It is a concept of great psychological and educational complexity due to its association with various personal, social, and educational variables. It holds importance in shaping the daily lives of individuals, families, and communities. Academic achievement represents that tangible outcome that carries all the indicators of success or failure for individuals in the tasks they undertake.

Perhaps one of the concepts and variables most closely associated with academic achievement is intelligence. As commonly believed and supported by numerous studies, intelligence has correlations with various personal characteristics, such as ambition, motivation, creativity, problem-solving ability, and academic achievement. It has been observed that individuals with high intelligence exhibit much higher motivation and achievement orientation compared to individuals with low intelligence. This suggests that academic achievement and success can be predicted through individuals' intelligence levels (Al-Zaghloul, 2012).

Based on the traditional conception, which has been affirmed by modern educational literature regarding the close association between intelligence and academic achievement, and with the development witnessed in the research and interpretive theories of intelligence, leading to Gardner's theory of multiple intelligences, the nature of the relationship between these types of intelligences and academic achievement is once again questioned. Many studies have delved into this field, and while many of them have confirmed this relationship, they have varied in some details concerning the types of intelligence and academic subjects. This prompted some researchers to be more precise in investigating the relationship between certain types of intelligence and the achievement of specific academic subjects. This was emphasized in a study by Ryan (2013), which

aimed to identify the multiple intelligence patterns among secondary school students in the Directorate of Education in Hebron, Palestine. The study also aimed to examine the differentiation trends in these intelligences based on variables such as gender, grade level, academic track, and mathematics achievement level.

The study's results showed that the common intelligences among students were ranked as follows: interpersonal, intrapersonal, verbal-linguistic, bodily-kinesthetic, musical, logical-mathematical, spatial, and naturalistic. Furthermore, statistically significant differences were found in the overall multiple intelligences and in the verbal, logical, and visual intelligences based on mathematics achievement level, favoring students with high achievement in mathematics.

As for the study conducted by Afana and Al-Khazendar (2004), it aimed to identify the levels of multiple intelligences among elementary school students in Gaza and determine the relationship between multiple intelligences and students' achievement in mathematics, as well as their inclinations. The study revealed that the study sample possessed varying degrees of multiple intelligences in the overall elementary education stage in Gaza, with logical-mathematical intelligence ranking first. There was a close relationship between logical-mathematical intelligence and achievement in mathematics. The study also showed that the higher the logical-mathematical intelligence, the higher the achievement in mathematics and the inclination towards the subject.

Another study by Al-Adl (2006) aimed to explore the effectiveness of a program based on the theory of multiple intelligences in developing literary taste skills among preparatory stage students. The results indicated that linguistic, spatial, and musical intelligences were among the strongest predictors of students' literary taste.

This was also observed in a study by Fahd (2014), which aimed to examine the relationship between visual intelligence and achievement in mathematics among first-grade middle school students in Baghdad. The researcher employed a descriptive-analytical approach with a sample of 400 male and female students. Visual intelligence scale and an achievement test were used as research tools. The study's results indicated a low level of achievement despite the sample's possession of intelligence, as well as a weak correlation between achievement and spatial visual intelligence.

The study conducted by Al-Masara (2015), which was applied to 263 eighth-grade students, concluded that students' linguistic intelligence was high, while logical intelligence was average. It revealed a statistically significant positive relationship between linguistic and logical intelligence on one hand, and students' grades in Arabic language and mathematics on the other hand. The study also indicated the possibility of predicting students' achievement in Arabic language solely based on linguistic intelligence, while it was not possible to predict mathematics achievement based on linguistic and logical intelligence.

In the studies exploring the relationship between multiple intelligences and academic achievement, it has been observed that although the importance of these cognitive abilities in academic achievement is evident, the correlations between them vary depending on the subjects and the types of intelligences. This led to the emergence of a general perception and hypotheses emphasizing the nature of certain types of intelligences and their relevance to specific fields of study. For example, many believe there is a connection between spatial visualization tests and success in mechanical engineering, drawing, medicine, dentistry, and other professions (Ahmed, 2010, p. 109). Similarly, logical-mathematical intelligence is associated with logical thinking, precision, as seen in computer programmers, analysts in finance and data, mathematics teachers, or tasks that require creative imaginative thinking, as found in engineers, electricians, astronomers, and others (Bahaa Eddin, 2017).

Based on the domains that attract individuals with these two types of intelligence, despite their differences in many areas, there are overlapping domains where their interests converge. These

domains may have correlations with certain academic subjects. However, we focused on the two subjects that are of interest to educators and parents as they are fundamental in primary education, namely, Arabic language and mathematics. Therefore, this study examines the question: Is there a relationship between logical-mathematical intelligence, spatial visualization intelligence, and academic achievement in Arabic language and mathematics among primary school students?

To answer the research question, the researchers propose the following four hypotheses:

- There is a statistically significant relationship between logical-mathematical intelligence and achievement in the Arabic language for primary school students.

- There is a statistically significant relationship between logical-mathematical intelligence and achievement in mathematics for primary school students.

- There is a statistically significant relationship between spatial visualization intelligence and achievement in the Arabic language for primary school students.

- There is a statistically significant relationship between spatial visualization intelligence and achievement in mathematics for primary school students.

The study aims to uncover the relationship between logical-mathematical intelligence on one hand and the achievement in both Arabic language and mathematics on the other hand, for primary school students. Additionally, the study aims to explore the relationship between spatial visualization intelligence and the achievement in both Arabic language and mathematics for primary school students.

This study derives its significance from the nature of the theory it addresses, namely the theory of multiple intelligences. This theory possesses attributes that enable it to be at the forefront of theories that positively impact educational practices. Furthermore, the theory is continuously evolving and being updated, allowing it to keep pace with the rapid developments. This enables us to disclose new interpretations and patterns related to intelligence.

Although this study focused only on two types of multiple intelligences, namely logical-mathematical intelligence and spatial visualization intelligence, its enlightening implications for professionals in the field contribute to the discovery of talents that have been neglected due to the traditional narrow view of intelligence. Embracing this theory in planning and management processes simplifies the achievement of goals for teachers by selecting appropriate methods and classroom activities that cater to the predominant intelligences among students.

The significance of academic achievement in educational work, as well as the concern of parents who prioritize their children's educational performance, makes researching academic achievement important. Coupled with the latest theories of intelligence, it amplifies this significance, and the benefits derived from the results of this study and similar ones encompass various educational domains. They extend from teaching methods and strategies employed by teachers in classrooms to interactions and achievements demonstrated by learners, ultimately reaching the highest educational authority responsible for designing and developing curricula and educational programs to achieve desired educational goals.

Furthermore, the uniqueness of the sample, represented by primary school students, adds to the importance of this study. Considering that education at the primary level serves as the foundation for subsequent educational stages, conducting research targeting this group of students is a service that positively impacts all educational levels.

The results of the study, as they help identify areas of academic weakness in some individuals, can also indicate the effectiveness of various interventions that apply the principles of multiple intelligences theory in overcoming encountered difficulties.

2- Theoretical Framework

2-1- Multiple Intelligences

Initially, Gardner believed that human intelligence, through traditional intelligence theories, was not fully understood and appreciated. He justified this by stating that traditional intelligence tests relied on a small portion of cognitive abilities and were unfairly limited to solving problems related to logical-mathematical and verbal-linguistic aspects. For example, these tests did not measure spatial ability, which allows young children to manipulate objects manually or construct three-dimensional structures, among other overlooked aspects. Furthermore, traditional intelligence tests could assess academic performance but were incapable of predicting professional performance. This gap between measured student ability and actual performance prompted Gardner's attention (Najm, 2007).

These gaps were not a recent concern for Gardner; they had long intrigued him since childhood. They played a significant role in challenging his perception of traditional intelligence. Gardner mentioned that during his youth, he had an interest in certain arts. However, as he began studying cognitive psychology and developmental psychology, he was surprised by the complete absence of perspectives that led to the understanding of the arts and the neglect of artistic abilities associated with intelligence. This compelled him to pursue his early goal of filling this gap, establishing a place for the arts in academic psychology, and renewing the vision of intelligence from a broader perspective (Gardner, 2003).

In addition to Gardner's critical view of traditional intelligence theories, which he held since childhood, and his relentless efforts to find explanations for their weaknesses, there were other factors that contributed to the emergence of his theory. One of these factors was his work in what is known as "Project Zero," a research project founded by the philosopher of art, Nelson Goodman, at Harvard University in 1967. The project aimed to study cognitive development in children and its educational implications (Gardner, 2003).

In 1979, the Van Leer Foundation requested a scientific research study from Harvard University that aimed to evaluate individuals' scientific knowledge and mental abilities and determine how they could be utilized in various situations throughout an individual's life. As a result, a research team was formed, comprising professors and researchers from various disciplines, including diverse knowledge from the humanities, natural and philosophical sciences, as well as social sciences in their various branches. Gardner was one of the prominent members of this research team. At that time, he was particularly interested in studying children's talents and the reasons behind their loss among adults who had suffered brain injuries. The regular scientific meetings and discussions within the project provided Gardner with validation for his intuition, which always emphasized the differentiation in the nature of human minds and their brain compositions. He rejected the idea that humans possess a single intelligence and that dealing with the problems we face requires a single intelligence and a single mental capacity, considering it unconvincing and misleading (Al-Sultani, 2015).

And thus, Gardner had the opportune chance to study intelligence in a systematic and profound manner, relying on several diverse disciplines ranging from psychology and neuroscience to humanities and arts. These factors played a significant role in shaping the direction of intelligence research, culminating in his new theory presented in his book "Frames of Mind" in 1983, known as the theory of multiple intelligences. Gardner rejected the idea that intelligence is a singular capacity and emphasized that intelligence encompasses several types. Initially, he formulated a list of seven intelligences, which are as follows:

1. Linguistic Intelligence: Individuals with this type of intelligence excel in creative writing, speaking, and rhetoric. They have a greater ability to learn languages and often utilize language to achieve specific goals.

2. Logical-Mathematical Intelligence: This intelligence involves the ability to solve logical problems or mathematical equations. Individuals with this intelligence are better equipped to deal with scientific issues and comprehend them (Ibrahim, 2011, pp. 41-43).

3. Spatial-Visual Intelligence: This intelligence grants individuals the ability to perceive precise mental images and easily construct them to solve problems. This intelligence is not limited to visual domains - Gardner notes that spatial intelligence also develops in blind children.

4. Musical Intelligence: This intelligence encompasses the ability to recognize musical compositions, tones, melodies, and rhythms, (auditory functions are required for an individual to develop this intelligence in terms of pitch and tone unity, but they are not necessary for rhythm comprehension).

5. Bodily-Kinesthetic Intelligence: It is the ability to translate an individual's mental capabilities into coordinated bodily movements. Therefore, this intelligence refutes the prevailing belief that mental and physical activities are unrelated (Gardner, Katie, & Joanna, 2011).

6. Social Intelligence: This intelligence pertains to one's relationship with others. Individuals with this type of intelligence have the ability to understand the intentions, motivations, and desires of others, enabling them to collaborate effectively.

7. Intrapersonal Intelligence: Individuals with this intelligence have the ability to understand their own capacities, appreciate their thoughts, and emotions, allowing them to organize their lives successfully (Bahaa Eddin, 2017, p. 43). Gardner added an eighth intelligence in 1995, known as Naturalist Intelligence, which is associated with the environment. It is the ability to recognize and classify nature. There is also Existential Intelligence, which is related to being and existence. It is the capacity to comprehend the external world. However, Gardner did not fully endorse this type of intelligence (Afana & Al-Khazendar, 2004).

Establishing specific criteria that can be relied upon to determine whether a particular ability qualifies as intelligence or not can be summarized as follows:

- It should be considered with regard to the relative isolation of abilities. Individuals with autism, brain injuries, and many other exceptional cases such as individuals with disabilities have shown development and excellence in a specific intelligence while exhibiting a noticeable decline in other intelligences.

- It should have neural representation responsible for the vital activities performed by the individual, and it should be distinct and independent from other human functions.

- There should be a developmental history for each intelligence. Intelligence is not an absolute, fixed trait from birth through life. Rather, each intelligence has its own developmental pattern, starting in childhood and growing through successive developmental stages.

- It should have roots in evolutionary biology. In other words, intelligence is embodied in some practices of ancient humans or even living organisms, indicating its value and persistence.

- It should be expressible through symbols during spontaneous or formal learning, depending on the type of intelligence.

- It should be supported by representation in the results of previous psychological assessments of intelligence.

- It should exhibit distinctiveness from other intelligences in various psychological experiments.

- There should be a system that processes and outputs information in a final form. Each of these intelligences has cognitive processes connected to other domains of mental abilities (Gardner, Katie, & Joanna, 2011).

2.2 Logical-Mathematical Intelligence:

According to Najm (2007), this intelligence is defined as the ability to effectively deal with numbers and reasoning. Individuals with this type

of intelligence possess precision in processing patterns and relationships that involve logical and abstract issues. They have the ability to think logically, handle problems scientifically, and demonstrate exceptional insight in connecting cause and effect compared to their peers.

Al-Masarwa (2015) described logical-mathematical intelligence as the archetypal form of intelligence. It manifests in mental processes that involve classification, grouping, design, as well as in logical relationships, mathematical operations, and the use of abstract concepts.

The characteristics of individuals who excel in logical-mathematical intelligence are numerous and diverse, as mentioned by Bahaa Eddin (2017).

- He possesses the ability to effortlessly calculate numbers.

- He prefers mathematics and sciences over all other subjects.

- He finds pleasure in games and puzzles that rely on logical thinking for their solutions.

- He always maintains critical judgments of others' words or actions, whether at home or work.

- He retains abstract concepts that may not rely on words or images.

Additionally, among the characteristics mentioned by Mohammed (2006), we find:

- They find pleasure in solving puzzles or activities that involve numbers and manipulating them.

- They prefer tasks and activities that adhere to structured rules.

- They can learn through classification, categorization, and generalization based on relationships that connect elements.

- They are drawn to complex calculations that stimulate their sense of challenge.

- They tend to interpret and analyze when dealing with heterogeneous problems.

The dimensions of logical-mathematical intelligence, as outlined by Ibrahim (2011), are as follows:

A- Problem-solving: This dimension manifests in cognitive activities that generate ideas, principles, and rules.

B- Precision: This dimension is evident in cognitive activities specialized in extracting and deducing accurate solutions and results.

C- Beyond Knowledge: This dimension manifests in the process of thinking and the activities the individual engages in to organize their cognitive processes.

D- Logic: This dimension is evident in cognitive activities that involve comprehending arithmetic operations and connecting them together.

3- Spatial-Visual Intelligence

Jaber (2003) describes spatial-visual intelligence as the ability to perceive the precise spatial visual field. This ability can be found in scouts, guides, and hunters, but it doesn't stop there. It is further utilized in transformations, as seen in architects, interior designers, artists, and innovators. Individuals with this intelligence excel in their sensitivity to colors, lines, shapes, nature, and everything related to surrounding spaces and areas. Additionally, they grasp the relationships that connect all these elements. Spatial-visual intelligence is also characterized by the capacity to create and shape mental images and translate them into visual images and diagrams, while appropriately orienting oneself in a spatial matrix (Jaber, 2003, p. 11).

According to Abu Salem (2017), the characteristics of individuals with spatial-visual intelligence are as follows:

- They have a keen sense of spatial awareness and can easily navigate and orient themselves in physical environments.

- They excel in visualizing and mentally manipulating objects and spatial relationships.

- They possess strong observation skills and attention to detail.

- They demonstrate creativity in designing and arranging visual elements.

- They have a strong aesthetic sense and appreciate visual art and design.

- They can interpret and understand maps, diagrams, and spatial representations effectively.

- They have the ability to accurately or elaborately describe clear visual images.

- They prefer watching visual presentations such as movies, slides, and others.

- They excel at reading maps, charts, and diagrams with much greater ease compared to reading texts.

- They stand out with a higher frequency of lucid dreams compared to his peers.

- They tend towards artistic activities and draws in a manner that surpasses his age.

- They find pleasure in solving puzzles, riddles, mazes, and all activities involving visual interaction.

They possess the ability to create attractive three-dimensional structures better than his peers.

For the dimensions of spatial-visual intelligence mentioned by Ibrahim (2011), they are as follows:

A- Spatial Inference: This dimension manifests in cognitive activities related to sudden observations and precise tracking of perceived details.

B- Spatial Relationships: This dimension manifests in cognitive activities characterized by comprehensive comprehension and precise perception of the visual external world.

C- Spatial Awareness: This dimension manifests in cognitive activities that involve perceiving spatial directions, angles, and the movement of non-static objects.

D- Originality: This dimension manifests in cognitive activities that focus on extracting and generating new ideas that have not previously appeared.

2-4- Educational Achievement:

Among these definitions, we present, by way of reference but not limited to, what was mentioned by (Deeb, 2010):

Where Taher Saadallah (1991) defined it as a specific level of performance or competence in school work, as evaluated by teachers or through standardized tests, or both.

As for Ashawi Abdelrahman (1984), he defined it as the amount of knowledge and skills acquired by an individual as a result of training and previous experiences. The term "educational achievement" is often used to refer to academic achievement or learning, or the achievement of the worker from the training programs they attend.

The objectives of educational achievement are to impart behavioral patterns to learners in accordance with the vision of the educational system. It helps identify responses that deserve reinforcement and others that require appropriate solutions. It also indicates the pace of growth and progress in the learning process, increases motivation for learning, and enables teachers to adapt teaching methods and approaches based on the difficulties revealed by the results of achievement in certain subjects, as well as the prevailing differences among learners. (Ben Youssef, 2018).

An observer of the process of educational achievement realizes that there are several internal and external interrelated factors that influence it. Understanding and identifying these factors is important in order to support and enhance the educational achievement process, as well as reduce and avoid any obstacles that hinder educational achievement. These factors can be summarized in three categories, as described by (Ahmed, 2010):

Self-related factors: which are further defined by three sub-factors, are as follows:

A- Personal and emotional traits of the student.

B- Inherent characteristics of the student.

C- Intellectual abilities of the student.

Social factors:

The environmental factors, with the school being the most important among them, include the following school-related factors:

A- The teacher.

B- Examinations.

C- Peer group.

3- Method and Tools

3-1- Sampling

The study targeted students enrolled in the third educational district of primary education in the municipality of Al-Bayada. This district consists of seven primary schools. A random sampling method was employed, relying on voting to determine the selection. Consequently, two schools were chosen: Ghania Ahmed Elementary School and Abu Bakr Al-Siddiq Elementary School. Since the concerned academic subjects, especially Arabic language, tend to be more comprehensive in dealing with the dimensions of these subjects at the second stage of primary education, and considering that this stage includes the third, fourth, and fifth grades, we preferred fourth-grade students. This preference was based on the fact that fifth-grade students engage in a final season that may be affected by other variables, in addition to the fact that third-grade students are relatively new to dealing with linguistic phenomena, which may affect their achievement in this subject in a manner that does not align with the objectives of our research. The study sample consisted of 72 students who were selected randomly, as previously mentioned. Table 1 illustrates the distribution percentages of the study sample according to gender and schools.

Table (1): Sample Distribution Ratios by Sex and Schools

Ratio	Number			School
	Total	females	males	
43.06	31	19	12	**Ghania**
56.94 %	41	25	16	**Abu , Bakr Al Siddiq**
100 %	72	44	28	**Total**
	100 %	61.11	38.89	**Ratio**

Prepared by the researchers

3-2-1 Intelligence Measures: Logical-Mathematical and Spatial Intelligence

After reviewing numerous measures and tests related to multiple intelligences, and with the aim of selecting the appropriate tool that aligns with the developmental characteristics of the study sample's age group, "Gardner's School-Age Children Checklists" were adopted. These checklists were developed by Howard Gardner based on his theory of multiple intelligences, which enables the identification of various intelligences possessed by children (Mohammed, 2006). The checklists included seven scales, each representing a different type of multiple intelligence. In this study, we relied on the measures of logical-mathematical intelligence and spatial intelligence. The Arabic version of these measures, translated by Adel Abdullah Mohammed (2006), was applied to ensure compatibility with the Arabic environment while preserving the authentic components of the scales. The goal of the translation was diagnostic, aiming to obtain accurate and valid results regarding the child's different intelligences.

To ensure the validity of the measures in the Arabic environment, various methods were employed, including content validity. As the content does not change with the environment, the measures related to the foreign environment were deemed sufficient, as they were originally designed based on Gardner's theory of multiple intelligences.

Regarding criterion validity, the "Multiple Intelligences Checklist" was used as an external criterion. The difference in this measure, also developed by Howard Gardner, is that it encompasses all seven types of intelligences in one checklist. This measure was standardized with high specifications and was also translated by the same translator. It was administered to parents and teachers of children, who were categorized into groups, with each group representing one of the seven scales. Each group consisted of 30 children.

The correlation analysis results between the adopted measures in our study and the dimensions represented in the criterion measure were as follows:

Table (2): Correlation coefficients of children's scores in the responses of parents and teachers between the two scales and the test scale.

Teachers' response		**'Parents response Factor 1**		
Significance	T value	Significance	T value	**Standards**
0.01	0.80	0.01	0.78	**Mathematical logic intelligence**
0.01	0.92	0.01	0.71	**Optical spatial intelligence**

Prepared by the researchers

Based on Table 2, the correlation coefficients are strong and statistically significant at the 0.01 level, which supports the validity of the measures. Additionally, the discriminant validity of the measures was calculated after applying them to several homogeneous groups, with differences in means ranging from 8.65 to 17.23. These differences are statistically significant at the 0.01 level.

The results clearly demonstrate that these measures, in their Arabic form, exhibit high levels of validity and statistical significance, qualifying them to be reliable for use in this study.

To ensure the stability of the Arabic version of the checklists, they were applied to a sample of 227 children. Various methods were employed to assess the stability, and the results of the adopted measures in the study were as follows:

Test-retest reliability: The time interval between the first and second administrations was two weeks, and the stability coefficients between them were as follows:

Table (3): Coefficients of stability of the two scales after re-application.

Significance level	**Coefficient of stability**	
0.01	0.88	**Mathematical logic intelligence**
0.01	0.92	**Optical spatial intelligence**

Prepared by the researchers

Table 3 illustrates that the stability coefficients for the measures are strong and statistically significant at the 0.01 level.

To assess internal consistency, the Cronbach's alpha coefficient was used on the same sample. The results of the stability coefficients for the items of each measure with their total score are as follows:

Table (4): The coefficient of stability of the two scales by calculating the internal consistency.

Significance level	**Coefficient of stability**	
0.01	0.90 – 0.63	**Mathematical logic intelligence**
0.01	0.88 – 0.62	**Optical spatial intelligence**

Prepared the researchers

Through Table 4, it becomes evident that the stability coefficients for the items of each measure and their total score were all statistically significant at the 0.01 level. This indicates a high degree of stability.

3-2-2 Achievement Tests:

Achievement tests for the subjects of Arabic language and Mathematics for the third term of the 2021/2022 academic year were also adopted as a study tool. The distribution of the obtained grades encompassed all proficiency levels, as shown in Table 5. The average score for each subject slightly exceeded 5/10, and their standard deviation also slightly exceeded 2. This implies that the achievement results for the two subjects in question were well-represented, including all proficiency levels (high, medium, low).

Table (5): Arithmetic mean and standard deviation of the scores of achievement tests for subjects.

Standard deviation of scores	Arithmetic average of scores	
2.74	5.77	**Achievement in Arabic language**
2.78	5.80	**Achievement in mathematics**

Prepared the Researchers

4. Results

This study was based on four research hypotheses that revolve around the logical-mathematical intelligence and spatial intelligence and their relationship with academic achievement in the subjects of Arabic language and Mathematics for primary school students. To examine the study hypotheses, the statistical package SPSS was employed, using the Pearson correlation method. The results are as follows:

4.1 Presentation and Analysis of the Results of Hypothesis 1:

The hypothesis states: “There is a statistically significant relationship between the level of logical-mathematical intelligence and the academic achievement in the Arabic language for primary school students.” After data processing, the results obtained are presented in Table 6.

Table (6): Correlation coefficient between the scores of the Mathematical Logic Intelligence Scale and the score of the achievement test for the Arabic language for primary school students.

Resolution	Statistical significance	Correlation coefficient value	The two variables
function at 0.01	0.000	0.61	**Mathematical logic intelligence**
			Achievement in Arabic language

Prepared by the researchers

Through Table 6, it can be observed that the p-value (0.000) is less than 0.01. Therefore, there is a statistically significant relationship between the level of logical-mathematical intelligence and academic achievement in the Arabic language at a significance level of 0.01, with a correlation coefficient of 0.61.

4.2 Presentation and Analysis of the Results of Hypothesis 2:

The hypothesis states: "There is a statistically significant relationship between the level of logical-mathematical intelligence and academic achievement in Mathematics for primary school

students." After examining this hypothesis, the results obtained are presented in Table 7.

Table (7): Correlation coefficient between the scores of the Mathematical Logic Intelligence scale and the score of the achievement test for mathematics for primary school students.

Resolution	Statistical significance	Correlation coefficient value	The two variables
function at 0.01	0.000	0.69	**Mathematical logic intelligence**
			Achievement in mathematics

Prepared by the researchers

Through Table 7, it can be observed that the p-value (0.000) is less than 0.01. Therefore, there is a statistically significant relationship between the level of logical-mathematical intelligence and academic achievement in Mathematics for primary school students at a significance level of 0.01, with a correlation coefficient of 0.69.

4.3 Presentation and Analysis of the Results of Hypothesis 3:

This hypothesis states: "There is a statistically significant relationship between the level of spatial intelligence and academic achievement in the Arabic language for primary school students." After data processing, the results obtained are presented in Table 8.

Table (8): Correlation coefficient between the scores of the spatial intelligence scale and the score of the achievement test in the Arabic language for primary school students.

Resolution	Statistical significance	Correlation coefficient value	The two variables
Non-function	0.922	0.01	**Optical spatial intelligence**
			Achievement in Arabic language

Prepared by the researchers

Through Table 10, it is evident that the results of this hypothesis were not significant. Therefore, there is no statistically significant relationship between the level of spatial intelligence and academic achievement in the Arabic language.

4.4 Presentation and Analysis of the Results of Hypothesis 4:

The hypothesis states: "There is a statistically significant relationship between spatial intelligence and academic achievement in Mathematics for primary school students." The measurement of this hypothesis resulted in the findings presented in Table 9.

Table (9): Correlation coefficient between the scores of the spatial intelligence scale and the score of the achievement test in mathematics for primary school students.

Resolution	Statistical significance	Correlation coefficient	The two variables
Non-function	**0.569**	**0.06**	**Spatial intelligence**
			Achievement in

Prepared by the researchers

Through Table 9, it is evident that the results of this hypothesis were not significant. Therefore, there is no statistically significant relationship between spatial intelligence and academic achievement in Mathematics.

5. Discussion of the Results:

Based on the results obtained from testing the four hypotheses, we can discuss the findings. The results of the first hypothesis confirmed the presence of a statistically significant correlation between logical-mathematical intelligence and academic achievement in the Arabic language. These findings align with the study conducted by Al-Masarweh (2015), which also found a statistically significant positive relationship between linguistic and logical intelligence and students' grades in the Arabic language. Additionally, similar results were found in a foreign study conducted by McMahon and Rose (2004), which explored the relationship between multiple intelligences and reading achievement in the native language for fourth-grade students in a school in Chicago. The study concluded that reading achievement could be predicted solely through logical intelligence.

The relationship between logical-mathematical intelligence and academic achievement in the Arabic language can be explained by the diverse language activities, such as reading texts, studying them, engaging in discussions about their content, and categorizing their elements. Additionally, both oral and written expression, as well as the study of grammatical, morphological, and orthographic phenomena, provide logical-mathematical intelligence with ample opportunities to be active, especially in situations requiring logical thinking. For instance, the study of grammatical phenomena, which follow established rules, involves a higher level of logical thinking compared to other activities. Furthermore, the cognitive process of text categorization, known for dividing texts into partial ideas, allows individuals with this type of intelligence to intuitively transition between ideas. Moreover, during discussions about texts or oral expressions, logical deductions can be made based on the causes and classifications that arise, along with other activities that stimulate cognitive performance in individuals with this type of intelligence. From a theoretical perspective, this study aligns to a considerable extent with their mentioned characteristics.

As for the results of the second hypothesis, as expected, they confirmed a strong relationship between logical-mathematical intelligence and academic achievement in mathematics. These results align to a considerable extent with numerous studies, including Al-Baladi's study (2016), which aimed to uncover the relationship between the average responses of elementary stage female students to multiple intelligences and their academic achievement in mathematics. The results regarding this objective revealed a statistically significant positive correlation between the two intelligences (logical-mathematical and spatial-visual) and high achievement in mathematics. Similarly, Afana and Al-Khazendar's study (2004) aimed to identify the levels of multiple intelligences among basic education students in Gaza and their relationship with achievement in mathematics. One of the notable results of this study was that the higher the level of logical-mathematical intelligence among students, the higher their achievement in mathematics and their inclination towards it.

Furthermore, the study conducted by Al-Rayyan (2013), which aimed to examine the differentiation in multiple intelligences according to various variables, including the level of achievement in mathematics, also yielded results indicating that logical intelligence was among the intelligences that showed differences based on the level of achievement in mathematics, favoring those with higher achievement levels in mathematics. These studies, along with others, consistently reinforce the strong association between logical-mathematical intelligence and achievement in mathematics. We have not come across any study within our knowledge that refutes this relationship. This can be attributed to the nature of mathematics, which deals with numbers, mathematical operations, and logical reasoning, providing

individuals with this type of intelligence a platform to showcase their creativity and excellence.

Regarding the third hypothesis, the results of its measurement indicated a lack of statistically significant relationship between spatial intelligence and achievement in the Arabic language. This finding contradicted several studies, including Hamad's study (2015), which aimed to uncover the effectiveness of a proposed therapeutic approach based on linguistic and visual intelligence for developing the skill of identifying language errors among sixth-grade students. The results of Hamad's study revealed statistically significant differences between the average scores of the experimental group in the pre- and post-application tests, in favor of the post-application test. Another study by Al-Adl (2006) aimed to explore the effectiveness of a program based on the theory of multiple intelligences in developing literary appreciation skills among preparatory stage students. The study's results indicated that linguistic, spatial, and musical intelligences were among the strongest predictors of literary appreciation among the experimental group students. In contrast, one of the foreign studies that contradicted our findings in measuring this hypothesis is the study by Diezmann, Carmel, and Watters (2000), which aimed to observe and enhance spatial-visual intelligence in children during the early stages of learning reading, writing, and arithmetic. The study's results showed that children with a high level of spatial-visual intelligence also exhibited high-level skills in early reading, writing, and arithmetic learning.

The obtained results of our study, which demonstrated the absence of a relationship between spatial-visual intelligence and achievement in the Arabic language, can be attributed to the nature of the achievement test used in the second stage of primary education. This test primarily focuses on questions that stimulate linguistic and logical-mathematical intelligences, while neglecting many indicators that assess other intelligences. Returning to the problem of this study, Gardner warned against falling into this long-standing trap when he stated that "learner capabilities are not limited to linguistic and logical-mathematical intelligences alone." Furthermore, activities that appeal to individuals with spatial intelligence in this subject, such as oral expression based on visual descriptions or reading texts accompanied by evocative visuals, are not included in these tests. Individuals with this type of intelligence perceive these tests as mere blank papers lacking the inspiring allure that motivates them to utilize their spatial-visual abilities.

As for the fourth hypothesis, the measurement results indicated a lack of statistically significant relationship between spatial-visual intelligence and achievement in mathematics. These results contradicted many previous studies, including the aforementioned studies by Al-Baladi (2016) and Al-Rayyan (2013). The former study found a statistically significant positive correlation between spatial-visual intelligence and high achievement in mathematics. The latter study revealed that spatial-visual intelligence differed significantly from other intelligences based on the level of achievement in mathematics, favoring individuals with high achievement. However, our study's results were relatively consistent with the findings of Fahd's study (2014).

The results of our study, which demonstrated the absence of a significant relationship between spatial-visual intelligence and achievement in the Arabic language, can be explained by the nature of the achievement test used in the second stage of primary education. The test's question pattern primarily targets linguistic and logical-mathematical intelligences, while lacking many indicators that assess other intelligences. Addressing the problem of this study, it is worth noting that Gardner cautioned against falling into this persistent old trap by stating that "learner capabilities are not limited to linguistic and logical-mathematical intelligences alone." Additionally, activities that attract individuals with spatial intelligence in this subject, such as oral expression relying on visual descriptions or reading texts accompanied by evocative visuals, are not included in these tests. Individuals with this type of intelligence perceive these tests as mere blank papers that lack the inspiring allure that motivates them to utilize their spatial-visual abilities.

As for the fourth hypothesis, the measurement results concluded that there is no statistically significant relationship between spatial-visual intelligence and achievement in mathematics. These results contradicted many previous studies, including the mentioned studies in the discussion of previous hypotheses by Al-Baladi (2016) and Al-Rayyan (2013). The former study found a statistically significant positive correlation between spatial-visual intelligence and high achievement in mathematics. The latter study revealed that spatial-visual intelligence differed significantly from other intelligences based on the level of achievement in mathematics, favoring individuals with high achievement. However, our study's results were relatively consistent with the findings of Fahd's study (2014).

As for the fourth hypothesis, the measurement results concluded that there is no statistically significant relationship between spatial intelligence and achievement in mathematics. These results contradicted many previous studies, including the mentioned studies in the discussion of previous hypotheses by Al-Baladi (2016) and Al-Rayyan (2013). The former study found a statistically significant positive correlation between spatial-visual intelligence and high achievement in mathematics. The latter study revealed that spatial-visual intelligence differed significantly from other intelligences based on the level of achievement in mathematics, favoring individuals with high achievement. However, our study's results were relatively consistent with the findings of Fahd's study (2014).

Fahd's study aimed to explore visual intelligence and its relationship to achievement in mathematics among first-year middle school students. Its results indicated a lack of achievement despite the sample's possession of intelligence, as well as a weak correlational relationship between achievement and spatial-visual intelligence. Our measurement results aligned relatively with Sholk's study (2002), which primarily aimed to uncover the impact of multiple intelligences on reading, writing, and arithmetic achievement among high school students in the United States. The study yielded distinct profiles of intelligences and their relationships with achievement test scores in the relevant subjects. Among the confirmed findings was that logical-mathematical, linguistic, and social intelligences were the primary and most prominent intelligences for the mathematics test. However, the profiles did not reveal a relationship between spatial-visual intelligence and achievement in mathematics.

Through the variability in similar studies regarding the relationship between spatial-visual intelligence and achievement in mathematics, and by referring to the literary heritage that has discussed this relationship, the results of hypothesis measurement can be interpreted based on the component part of these academic subjects, which is considered the key factor in weakening or strengthening the relationship between spatial intelligence and mathematics achievement. In other words, the percentage of its presence in the achievement test plays an influential role in determining the pace of this relationship, specifically within the field of engineering. This was elucidated by Macki (2016) who stated that engineering primarily focuses on shapes, objects, multidimensional spaces, and other elements that facilitate the learning process and enhance learners' ability to visualize objects in space, depict shapes and spaces, and establish relationships between elements. Additionally, it encourages sensitivity to colors and enhances their capabilities in conducting precise transformations that foster spatial visualization, which is commonly referred to as spatial-visual intelligence.

Referring to the implemented achievement tests, including official ones, we find that the subject of engineering does not exceed 15% of the overall estimation of the test. This has negatively impacted the results of individuals with spatial-visual intelligence.

Conclusion:

This study aimed to answer the question: Is there a relationship between both logical-mathematical intelligence and spatial-visual intelligence on one hand, and achievement in Arabic language and mathematics on the other hand, among elementary school students? After conducting the necessary procedures and following the required steps of

scientific research, our study arrived at the following results: There is a statistically significant relationship between logical-mathematical intelligence and achievement in both Arabic language and mathematics. However, there is no statistically significant relationship between spatial-visual intelligence and achievement in both Arabic language and mathematics.

The noteworthy observation from these results is the confirmation of the relationship in the hypotheses regarding logical-mathematical intelligence and the achievement in the two subjects of interest. On the other hand, the relationship was absent in the hypotheses concerning spatial-visual intelligence and the achievement in the two subjects. This can be generally attributed to factors related to the nature of the implemented achievement tests, as they are based on an outdated approach that serves specific intelligence patterns, namely logical-mathematical and verbal-linguistic intelligence, without considering other forms of intelligence that may excel in activities unrelated to or neglected by the achievement tests.

Based on the findings of this study, the researchers recommend the following:

- Revising the adopted methods of educational assessment that still rely on unfair achievement tests that disadvantage individuals with different forms of intelligence beyond linguistic and logical intelligence.

- Appreciating the recent decision issued by the Ministry of Education regarding the necessity of incorporating continuous assessment in language subjects, which includes various activities that provide individuals with different forms of intelligence the opportunity to demonstrate their abilities according to their dominant intelligence, as these activities were previously not included in the assessment. It is hoped that this initiative will be extended to other subjects as well.

- Striving to utilize the available Multiple Intelligences theory in the field of education by conducting training courses and awareness workshops for teachers to understand the importance of this theory in educational performance and how to implement it in accordance with the diversity of intelligence and the suitability of various classroom teaching activities.

- Conducting further studies and expanding them to include other forms of intelligence, and examining their correlation with various variables that contribute to improving academic achievement in different subjects.

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