# Mental Arithmetic Ability and its Relationship to Working Visual Memory among Primary School Pupils

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**Abstract**

This study sheds the light on determining the correlation between mental arithmetic ability and working visual memory, and the sample of the study members consisted of 368 male and female pupils from private schools affiliated to the General Directorate of Education in Babylon In order to achieve the objectives of the current research, it was necessary to have a test to measure mental arithmetic for primary school pupils, and given the absence of a local or Arabic test within the limits of the researcher's knowledge, she decided to prepare a test in mental arithmetic consisting of five parts, four of which are related to numerical issues and a special part to verbal issues and to define the concept of arithmetic The researcher adopted the Reys 1993 study (Reys, 1993). Where the first part consists of the skill of addition and contains four paragraphs, the second part is related to the skill of subtraction and contains four paragraphs, the third part is related to the skill of multiplication and contains five paragraphs, the fourth part is concerned with the skill of division and contains five paragraphs, as for the fifth part, this part is specific to verbal skills and contains It is divided into four paragraphs distributed over the four arithmetic operations (addition, subtraction, multiplication, division), and thus the test paragraphs are (22) items. As for the working visual memory test. The test consists of (40) paragraphs in its final form, where the paragraphs are in the form of optical slides, and the first slides begin with two components in each slide, then gradually progress until they become (5-6) components. All are simple black and white shapes. The test can be applied individually or collectively, and in the case of applying the test in an individual way, it is possible to display the test on a computer and statistical analysis of the two test paragraphs was conducted and conclusions were reached on the basis of which a set of proposals and recommendations were developed

## Research problem

Mathematics in the primary stage is the mainstay and the solid foundation for building an integrated scientific thought that pupils use during the different educational stages. Mathematics in general and elementary school is required in particular, to pay attention to the process of teaching it and to ensure its effectiveness, by choosing the best methods in order to facilitate its teaching and make it an enjoyable subject for pupils. (Al-Haqil, 1999:118)

The development of mathematics curricula is a top priority for development, because of the many skills it possesses that the individual needs in his life, and among these important skills

are arithmetic, as individuals tend to find solutions to arithmetic problems with flexibility and accuracy. The pupils have shortcomings in performing arithmetic operations mentally, and this is evident in the arithmetic, when the pupils use the available means, including writing on paper or using the calculator (Majmull, p. 25, 2007).

The interest in mathematics is one of the factors of society's progress and development, and in this context, some see that mathematics is a ruling element in what is currently going on and what is expected in the future in terms of scientific and technological innovations. Utilitarianism that helps them organize their lives, and its learning contributes to preparing them to face the challenges of the future (Essam, p. 18, 2001). Helping pupils master basic arithmetic skills (Addition, subtraction, multiplication, division), in learning mathematics, is a basic requirement and the goal of these skills includes understanding and thinking, as well as helping pupils to understand numbers and the operations associated with them come by preparing pupils through accuracy and speed in performing operations, Besides mastery and knowledge of the basic facts and concepts of numbers (Al-Sawa'i, p. 56, 2004).

Visual working memory is highly correlated with reading and mathematics skills and it is related to mathematical achievement, as pupils who have difficulties in reading skill and the skill of acquiring mathematical concepts such as symbols, and these difficulties result from problems in working memory in terms of the inability to remember and the inability to retrieve information Cognitive and that there is a relationship between academic achievement and the capacity of verbal working memory and visual and spatial working memory. (Al-Zayyat, p. 176, 2007).

As (Nada 2009) explained that the pupils show clear disturbances in the processes that require memory, some of them have difficulty remembering information based on auditory memory or visual memory or information based on both auditory and visual memory together, and they may have problems learning to read, write, spell, or Performing arithmetic operations. (Nada, p. 22, 2009).

visual working memory is a set of cognitive processes, which temporarily store and process visual information such as: images, shapes, graphics, and it is measured by the degree, which the pupil obtains on the static and moving test ( Weijer-Bergsma, Kroesbergen and Luit,2015 Alloway, 2006).

Visual memory is one of the most important mental processes due to its impact on the cognitive path of the individual and its great role in learning, especially in the early stages of a child's life because of his dependence on visual stimuli in learning. And other areas where we need memory. Visual memory is an important part of memory, and this memory is important for success in reading, writing and communication for all people.

The problem of the current research lies in answering the following question:

Is there a relationship between arithmetic mental ability and working visual memory for primary school pupils?

**The importance of the research**

In recent years, the world has witnessed wide changes in school mathematics curricula, which led educators and those interested in teaching mathematics to reconsider the development of school mathematics curricula, to build an advanced technological society. To develop a new vision and make radical changes to these curricula required by the current and future conditions of life.

The mental arithmetic skill is one of the important basic skills in contemporary trends in teaching and learning mathematics, especially after the urgent need for pupils to acquire the minimum mathematical skills necessary to face the problems that they may encounter in different life situations, where Clark and Kelly suggested that 30% of arithmetic The user in everyday life is done mentally. (Al-Momani, p. 85, 2004).

The mental arithmetic skill is important in increasing the pupil's self-confidence if it is trained correctly. This feeling increases when the pupil realizes that when he uses mental arithmetic and approximation in making various calculations (Nuhad, p. 5, 1997).

Mental arithmetic on the mathematical achievement of primary school pupils is of importance to educators, interested parties and decision-makers in Iraq to the importance of developing school mathematics curricula for the primary stage on the basis of great interest in the diversity of teaching strategies and mental arithmetic because of their positive impact on the progress of pupils' achievement and skills in mathematics. They are traded in a parallel amplitude manner, and for this reason all information in the spatial region is processed once. If one of the applications of double coding in memory is that the information that can be held or achieved in both verbal and imaginative systems, which can hold more successfully than the information contained within a single system, the reason for this may be that people are able to obtain information through a special feedback process in the verbal or non-verbal case. ( Miller & Loftus, p. 40, 1978) ((Potter, p. 404, 1985).

Working memory is one of the most important cognitive abilities, as its importance lies in the individual's daily activities, such as: maintaining attention, following instructions, implementing instructions with multiple steps, remembering information for moments, and logical thinking. in processing information; As it is the center of awareness, cognition and understanding and has the main role in supporting the learning process for young and old alike, and the importance of its connection with the educational process and learning difficulties is not hidden (Swanson, 2001).

**Research Objectives**

The current research aims to identify

-Mental arithmetic for primary school pupils

-Working visual memory of primary school pupils

-The correlation between mental arithmetic and working visual memory among primary school pupils

**Research limits:** The current research is limited to primary school pupils in the Babil Governorate Center for the academic year 2020-2021

**Identifying the terms**

**First: mental arithmetic** / defined by

- Reys 1993 (Reys, 1993) is the ability to perform calculations without the use of pen and paper or any other computational aids (Reys, 1993:306)

-The National Council of Teachers of Mathematics 2000, NCTM, (as an essential life skill that helps develop pupils' confidence and make them have the skill to solve mathematical problems accurately and quickly. (NCTM, 2000),

- procedural definition The ability to perform arithmetic operations without the use of paper and pen or any other means, and it is measured by the total score obtained by (the pupil) from his answer to the test items that will be approved for this purpose.

**Second: Working visual memory** / defined by:

- Zayat, 1995 It is an active dynamic system that operates by synchronous focus of both storage and processing requirements and is an active processing component that transforms and transfers information from long-term memory (Al-Zayyat, p. 26, 1995).

- Al-Rakkad, 2010. It is a complex cognitive process with mental activity that is not isolated from other mental functions such as (attention, perception, storage, response, etc. and others) (Al-Raqqad, p. 54, 2010).

- Weiger et al., 2015: It is a set of cognitive processes that cache and process visual information such as: images, shapes, still and animations. (Weiner-Bergsma, Kroesbergen and Luit, p. 23, 2015).

**The theoretical definition**

Visuo-spatial working memory: It is a set of cognitive processes that temporarily store and process visual-spatial information, such as: images, shapes, still and animated graphics (Anderson & Spellman, p. 54, 1995).

**The procedural definition**

A group of cognitive processes that temporarily store and process visual-spatial information, and it is measured by the total score obtained by the pupil (the pupil) from answering the test items that will be approved for this purpose.

**Theoretical framework**

**First: mental arithmetic ability**

Mental arithmetic is defined as performing one or more arithmetic operations or solving an arithmetic problem without the help of writing, and it is mentioned that

mental arithmetic requires mental effort and exercise. Mental arithmetic, and an example of mental arithmetic (if the learner calculates the product of multiplying two numbers (2 x 97), The number 97 is close to 100, so it multiplies 2 x 100 = 200, then subtracts 6 from 200, so the result is 194 because the number 97 is 3 less than the number 100, so 2 x 3 = 6, then 200 - 6 = 194 This kind of thinking is doing arithmetic operations is arithmetic Mentally, because it employs the basic properties in performing these operations, such as distributing multiplication over subtraction (Dawood, p. 88- 200).

Some see that mental arithmetic is just numbers and speed in arithmetic, but the truth is beyond that, mental arithmetic is the combination of the power of the mind and the science of logical analysis. The pupil must be calm and fully focused, and the mental development of the pupil is achieved by completing arithmetic operations and dealing with numbers mentally, and his intelligence rate also increases. Mental arithmetic is not just arithmetic techniques, but rather exercises to develop and raise the level of intelligence, and he can look at mental arithmetic as an educational tool that helps develop concepts and skills related to preparation and operations on them (Morgan, p. 33, 1999).

The modern approach to teaching mathematics takes into account the standards of numbers and arithmetic operations, especially at the elementary level. The National Council of Teachers of Mathematics in the United States stressed the need for pupils to be aware of the concepts of numbers and the relationships between them and numerical systems, and to understand the meaning of operations and how they are related to each other, as well as to calculate accurately and cleverly and give reasonable estimates (NCTM). ,2000)

The mental skill is one of the important basic skills in contemporary trends in learning and teaching mathematics, especially after the emergence of the urgent need for pupils to acquire the minimum mathematical skills necessary to face the problems that they may encounter in different life situations, and that 80% of the calculation used in daily life is done mentally. (Heirdssield, p. 95, 2002).

Since mental arithmetic is an accumulated experience, mathematics teachers for the basic stage must encourage pupils to develop new ideas and strategies for mental arithmetic skills, in addition to providing them with training and mentoring. Appropriate instruction for his pupils requires these strategies, the teacher must give his pupils the opportunity to try as many of these strategies as possible. (Van De Walle, 1994 - Heirdsfiled 2002 - Ramakrishnan, 2003). Mental arithmetic has a set of components that must be known and absorbed so that we can develop them, and they can be summed up in four components:

**Emotional components:** It is represented in providing pupils with mental arithmetic skills to develop their confidence in their ability to solve mentally. Children gain their confidence in the mental methods they use if they are allowed to build and discover mathematics on their own, especially when mathematics is presented in meaningful situations.

**Conceptual components:** It is represented in the ability to identify and distinguish the computational content in which the use of mental arithmetic is appropriate. Where the learner determines the method he uses to solve the problem according to

the process presented to him and through which he can reach the mathematical concept.

**Mental Arithmetic Strategies:** It is represented in the pupil's mental ability to solve problems according to what he deems appropriate, where the learner uses the appropriate strategy to solve according to his previous experiences and mental ability.

Also, mental arithmetic methods develop and improve in terms of quality and quantity through years of practice and training, and they must be learned from the first grade.

Mental arithmetic is one of the important topics that teachers should help pupils to present and develop new ideas through targeted training. (Amaiwa, p.165, 2001).

Memory is a common process in all the mental processes necessary for learning to occur, as through memory the various experiences the pupil is exposed to are stored and retrieved so that he can use them later. Memory is thus the cornerstone that ensures the safety of retaining the information previously learned by the individual through the processes and functions that take place in memory until the learning takes place.

A study (Korkman, Lahti-Nuuttila, Laasonen, Kemp and Holdnack, 2013), which dealt with the growth of visual-spatial perception, emotional perception, social perception, and visual memory at different ages (5-16) years, and the study concluded that there is a rapid growth of these Jobs from the age of (5-9) years, while the social cognition did not undergo any significant changes from (10-11) years, , followed by a slowdown in the rate of growth, and performance reaches a peak at the age group of (14-16) years in performance on executive functions, verbal memory, and visual-spatial perception, and also indicated that these functions can grow beyond 16 years . It was also necessary to note that the difficulties in learning arithmetic may be due to the limited attention capacity of the mentally gifted with difficulties in learning arithmetic, and that they have low cognitive load patterns, and they take longer to focus on the target stimuli and neglect the unrelated, and their attention span is small; As there is research linking patterns of cognitive loading and performance on selective attention tasks, ( Wang, Hu, Chai, Li and Chen ,2017).

Working memory is one of the most important components of the human memory system; It is the place in which thinking and problem solving takes place, through the functions of its verbal and visual components, which have a major role in operating different information in the current situation to which the individual is exposed, and storing that information in long-term memory and recalling it from it (Al-Adl, p. 13, 2000).

Baddeley, AD (2002), indicates that the visual-spatial component of working memory represents a qualitative system for temporarily operating and storing visual-spatial information in an active form, according to what is required by the situational task that the individual is about to accomplish, and this component receives the information either Through the senses or through information stored in long-term memory, this information is subject to operation or loss over time As indicated by (Jiang, Y. & et.als. (2000) that the characteristics and amplitude of the visual-spatial component of working memory are related to the characteristics of the organization of the visual-spatial perception of the individual, Also, this system operates the information related to each of the location, color, shape and all the special information

needed to organize and link the different properties of the visual material that the individual deals with, such as paying attention to all the geometric dimensions of the perceived shape that is to be remembered and activated in the working memory, and in general the most important functions of the component are determined Visual-spatial keeping the Visio-spatial information that the individual receives or needs in the current task in an active form Control tasks and information that need visual or spatial images. Activating the cues from the central executive organizer during the visual-spatial processing of information in the event that the visual tasks presented as difficult information.

This visual-spatial component of working memory retains qualitative, distinct and distinct information for the visual-spatial characteristics of the subject being dealt with. Organizing the visual-spatial information that has been stored to make it usable in more complex cognitive activities such as motor guidance in space, building mental images, mental imagery, drawing.... etc.

As Kosslyn, S. M. 1994 pointed out, the visual-spatial component of working memory includes sub-components that are directly subordinated to the work system of the central executive organizer, as follows:

-The visual attention window: Its function is to determine the part of the stimulus that is chosen for the individual to perform more operations than visual loading and operation.

-The attention shifting system: its function is to direct the focus of visual attention through the continuous stimulation of the attentional port to move the focus of attention to a new part of the figure. An information look-up system component: its function is to direct the visual search process in the light of information stored in long-term memory,

- The spatial-based & object-based visual recognition component: It includes two subsystems:

(a) A system for identifying information based on the nature of the shape of the stimulus, its function is to determine what the shape is. The function of this sub-component is supposed to analyze the physical properties and spatial location of the displayed stimulus, through each of: shifting visual attention around the properties of the stimulus, defining the properties of intersecting lines Component of the image of the figure and its parts, revealing the properties of the spatial relations of the component parts of the problem, visual scanning and matching between the properties of the displayed input figure and the properties stored before.

(b) The location-based information recognition system whose function is to determine where the figure is located, track changes that occur in the location of the figure according to time, and this sub-component is called the spatial recognition and tracking system. The study of "Ba. Zaglia" F. and another pazzaglia, F. & et.als. (1999), to the importance of distinguishing between the two sub-systems of the visual recognition component (what is visual) and (where is spatial) and the operation of information for both systems, which reflects the ability of this component to determine: the shape, its location, the spatial relationship between two or more locations in the space, which reflects The image of motion and its orientation in space.

It also assumed some differences between the visual functions and the spatial functions of the sub-systems of the visual recognition component, which are as follows:

Where the optical recognition system is concerned with operating visual information of a fixed nature represented in:

1- Realizing the properties of fixed shapes and realizing the variance in the properties of the shape.

2 - Awareness of the distinctive characteristics of the details of the figure and awareness of the general context of the figure as a whole.

3- Perceive different visual properties (meaningful and non-meaningful shapes, letters, facets, shadows).

4- Recognize the properties of the fixed spatial relationships of the parts of the figure that can be classified (the figures are connected or Unconnected: right/left, outside/inside, before/after).

5- Perceive the distribution of measurements of the parts of the figure, and the operation of visual information depends on spatial synchronization.

6- Awareness of the locations of the parts is spontaneous (simultaneous) information is processed at a low (or very low) level of activation.

As for the sub-component, the spatial recognition and tracking system is concerned with operating visual information of a changing spatial nature (spatial functions) represented in:

1 - Perceive the change in the position of the figure with the frequency of time and the operation of spatial information.

2- Perceive the position and position of the shape and the spatial relationship between the shapes in relation to each other.

3- Perception of the position of the figure depends on the perception of the observer.

4- Awareness of the different visual characteristics in light of spatial relations (size, direction and direction of movement, the link between the shape and its spatial location, the spatial relationships between the dimensions of the shape itself and the coordination of spatial relationships (spatial consistency) of the shape and other shapes in the same context.

**Visual barriers**

And those barriers are qualified to retain the information of the spatial nature of the shape, and they work in synchrony with the first and second components in order to preserve an active basic visual image of the displayed shape that derives its characteristics from the visual stimulus itself.

**an associative memory component**

Its job is to activate the visual information that was previously represented and stored in the long-term memory related to the information that is perceived in the current situation and necessary for it in order to establish relationships and hints between the prior and updated information to facilitate the completion of the task required by the current situation.

**Research Methodology and Procedures**

This chapter includes a presentation of the research methodology and its procedures represented in defining the research community and its sample, the method of selecting it, determining its tool and measurement procedures, as well as defining the statistical methods used in data analysis.

**First - Research Methodology**

The researcher adopted the descriptive approach in the comparative method, as it is the most appropriate method for the current research, as it focuses its attention on describing the phenomenon. The current research aims to know the mental arithmetic ability and visual working memory, so the method that will be adopted is the correlation relationship.

**Research community**

The research community means the total group with the elements that the researcher seeks to generalize the results of his research on (Odeh, Fathi, p. 159, 1992).

The current research community has identified the pupils of the schools of the Babylon Governorate Center (private schools) for the academic year 2021-2022, and their number is (8513) male and female pupils, with (3158) male and female pupils (37%) and (5355) female pupils, and they constitute 63

table of the research community

| gender | males | ratio | females | proportion |
|---|---|---|---|---|
| No | 3158 | 37% | 5355 | 63% |
| total | 8513 | | | |

**Research sample:** the sample means a group of individuals that represents a part of the community, as it is withdrawn from the original community according to an appropriate scientific method, and since the community includes two grades of primary school, the first and the second, and for both sexes (males and females) and for the purpose of accurately it, the sample was chosen by the class method Proportional random and this method requires the researcher to randomly choose items from each category in proportion to their true size in the original community as a whole (Vandalin, p. 393, 1985).

As for the sample size, the (Stephen's) equation was applied, according to which 368 males and female pupils were selected at a rate of 43%, distributed by (137) male pupils at a rate of (37%) and (231) female pupils at a rate of (63%), as shown in the table below.

The table of the sample

| gender | males | ratio | females | proportion |
|---|---|---|---|---|
| No | 137 | 37% | 231 | 63% |
| total | 368 | | | |

**Research tools**

**First, the mental arithmetic test**

To achieve the objectives of the current research, it was necessary to have a test to measure mental arithmetic for primary school pupils, and given the absence of a local or Arab test within the limits of the researcher's knowledge, so she decided to prepare a test in mental arithmetic consisting of five parts, four of which are related to numerical issues and a special part to verbal issues and to define the concept of arithmetic The researcher adopted the Reys 1993 study (Reys, 1993) as a theoretical framework in the construction of the test, as he defined the theoretical definition of the concept of mental arithmetic as (it is the ability to perform calculations without using paper and pen or any other computational aids (Reys, 1993:306). The paragraphs of the test number (22) paragraphs.

**Second: A test of working visual memory**

The test consists of (40) paragraphs in its final form, where the paragraphs are in the form of optical slides, and the first slides start with two components in each slide, and then progress to become (5-6) components, all of which are simple shapes in black and white. The test can be applied individually or collectively, and if the test is applied in an individual way, it is possible to view the test on a computer

**Test instructions**

The test instructions are a guide that shows the respondent how to respond to the paragraphs. Therefore, the researcher was keen to make the test instructions clear, and since the test consisted of (5) parts for the mental arithmetic ability test and (40) items for the visual working memory test, so the researcher has included All instructions are appropriate and the tasks of each part of the two tests, as was indicated when describing each of its parts.

**The validity of the paragraphs**

Although the logical analysis of the paragraphs may be shady at times due to its dependence on the subjective opinions of the arbitrators, it is considered necessary in the beginning of preparing the test paragraphs because it reveals the extent to which

the paragraph is apparently related to the characteristic that was prepared to measure it. (Al Kubaisi, p. 17, 2001).

For the purpose of verifying the validity of the two test items, it was presented in its initial form consisting of (22) items to test mental arithmetic ability and (40) items to test working visual memory, where it was presented to a group of arbitrators with expertise in the field of educational and psychological sciences, whose number reached (10) arbitrators. From them,

their observations and opinions on the validity of the paragraphs and instructions and the extent to which each paragraph is able to measure what it was prepared to measure and make what they see as amendments (rephrase, deletion, addition). Mental and visual working memory for primary school pupils.

**The experiment of clarity of the paragraphs and instructions**

The psychometric literature emphasized the need to check the respondent's understanding of the scale's paragraphs and instructions so that their answers are not random or deviate from the content of the paragraph (Faraj, p. 160, 1980).

For the purpose of identifying the clarity of the paragraphs and instructions, as well as calculating the average time taken to answer, the test was applied to a sample of (40) male and female pupils, as shown in the table below.

| The name of the school | No |
|---|---|
| Al – Zuhur school | 20 |
| Al – Nisur school | 20 |
| Total | 40 |

It became clear that the test items and its instructions were clear. As for the time taken to answer all test items

**The statistical analysis of the test items**

For the purpose of analyzing the paragraphs of the two tests, mental arithmetic ability and visual memory working statistically, a sample of (368) male and female pupils was selected and in the same manner in which the research sample was selected, that is, in a stratified random method with a proportional distribution from schools other than the schools that were included in the research sample, and then the paragraphs of the two tests were analyzed Mental arithmetic and visual memory working according to the following methods:

**First, the difficulty factor**

It means the level of complexity that the pupil faces in the correct answer to the test paragraph, and whether that level is high or average. It is natural that the ease of the paragraph is the opposite of its difficulty, meaning that the easy paragraph is the one in which most pupils can determine the correct answer without a problem because it does not represent a level of complexity Which is characterized by the difficult paragraph and determines the level of difficulty of the paragraph procedurally by the

percentage of pupils who achieved the correct answer to that paragraph (Kazim et al., p. 255-256, 2009).

In order to calculate the difficulty of the two test items, it relied on the answers of the pupils to whom the test was applied and the upper and lower groups, and to exclude the very difficult and the very easy items, the Ebel criterion was used, and in light of the criteria of difficulty referred to above, no item was excluded.

| Discrimination coefficient | Paragraph evaluation |
|---|---|
| 0,40 and more | very good |
| 0,20 - 39 | good enough, but may be subject to improvement |
| 0,19 and less | weak paragraphs are deleted or improved |

**Psychometric properties of research tools**

The basic conditions that should be met in educational and psychological research tools are the psychometric properties, the purpose of which is to increase the accuracy of the tools used in the research, so that these tools are effective and appropriate in measuring the research variables, as they give us a quantitative description of the measured phenomenon. The most important of these characteristics is honesty and stability. On this basis, the researcher has verified the validity and reliability of the tools used in her research. My agencies are: (Kline, P. 167, 2005, Kaplan & Saccuzzo, P. 135, 2013, Urbina, P. 127, 2014).

**1- Honesty**

Many researchers (Hamilton, 2007; Reynolds & Livingston, 2014, coolican, 2014; Hogan, 2015; Gregory, 2015) agreed that honesty is one of the most important characteristics of educational and psychological tests and standards because it reveals the integrity of its internal contents, especially since psychological variables are not subject to change. for direct observation, touch, and direct physical perception, as in the natural sciences such as physics and chemistry; And honesty refers to the ability of the measurement tools to measure the property for which they were developed, and honesty is also related to the goal for which the test is built and the decision made based on its grades. In order for the test to be described as valid, it must contain several indicators. Tests differ in their levels of validity depending on their approach or distance from the assessment of that characteristic or characteristic that they aim to measure. (Hamilton, P. 276, 2007; Reynolds & Livingston, P.163, 2014, P; coolican, P. 41, 2014; Hogan, P. 151, 2015; Gregory, P.118, 2015).

**Face validity**

The researchers (Kaplan & Saccuzzo, 2013; Hogan, 2015) agree that the apparent validity indicates the general appearance of the test as a means of measuring the target

phenomenon or problem. It reflects the indication of the extent to which the test appears to be measured, that is, that the test includes items that appear to be related to the variable being measured, and that the content of the test is consistent with its purpose; Ostensible honesty investigates the general appearance of the test or scale in terms of the type of paragraphs, how they are formulated and their clarity, the test instructions, accuracy and degree of clarity, the degree of difficulty of the paragraphs, the appropriate time in the case of timed tests, and the suitability of this test for the purpose for which it was set. Ease of practical possibilities in terms of printing, correcting and interpreting its results. (Kaplan & Saccuzzo, P. 136, 2013; Hogan, P. 155, 2015).

For the purpose of verifying the face validity of the two tests, mental arithmetic ability and working visual memory, the two tests were presented in their initial form to a number of specialized arbitrators in the Department of Educational and Psychological Sciences to judge the consistency of the test paragraphs with the definitions adopted by the researcher and to judge the suitability of these tools for the research sample. This was clarified when talking about the logical analysis of the test.

**Construct validity**

The researchers (Reynolds & Livingston, 2014; Gregory, 2015) indicated that the construct validity reflects the scale's ability to measure a specific hypothesis formation or a specific feature, and for this it is described as the most representative type of validity of the concept of validity. The degrees of the scale are based on the psychological construction of the characteristic to be measured or in the light of a specific psychological concept, and for this reason this type of honesty depends on a detailed description and analysis of the characteristic or characteristic to be measured, and it requires a lot of information about the behavioral manifestations indicating this characteristic or characteristic that is the subject of the measurement by looking at the Various sources and studies.(Reynolds & Livingston, 2014,P: 167; Gregory, 2015,P:127)

(Kaplan & Saccuzzo, 2013) emphasized that this type of validity represents the extent to which you can decide that the scale measures a specific theoretical construct or a specific characteristic. (Kaplan & Saccuzzo, P. 148, 2013). The researcher verified this type of honesty through two indicators:

**A - discriminating power**

One of the important characteristics that should be available in the vocabulary of the tests is Discrimination, which is the possibility of measuring individual differences using the vocabulary of these tests. (Kaplan & Saccuzzo, P. 88, 2005; Gregory, P. 130, 2015).

The discriminatory power is the indicator of the differences between respondents with high scores and low scores in the trait to be measured. The discriminatory power depends on the method of the two peripheral groups, as the total scores of individuals are divided into two categories (the upper group and the lower group) and then finding the coefficient of distinction between the scores of the two groups for each paragraph separately. (Gregory, P. 130, 2015).

Therefore, the researcher followed the following steps in finding the discriminating force:

Measurement tools were applied to the statistical sample of (368) male and female pupils, and then the researcher corrected the measurement tools.

The total scores for both the scale and the two tests are in descending order.

2- Selection of a percentage (27%) of the questionnaires with high scores to represent the higher group, and their number was (99).

3- Choosing a percentage (27%) of the questionnaires with low scores to represent the lowest group, and their number is (99).

4- Extracting the coefficient of distinction using the discrimination equation for the tests of mental arithmetic ability and visual working memory:

**(B) Internal consistency:** The researcher verified the internal consistency of the two tests, as the correlation coefficient was calculated between the degree of the paragraph and the total degree of the two tests, and no paragraph of the two tests was excluded.

**2- Reliability:**

The concept of test stability as indicated by researchers (Kline, 2000; Hamilton, 2007; coolican, 2014) refers to the concept of confidence or reliability in the test results, meaning that the test estimate for the apparent degree or the attribute under measurement is stable if it is repeated at different times; A fixed scale gives the same results if the same thing is measured several times in succession. Hence, the concept of stability means the extent to which the test measures the true amount of the trait that it aims to measure. The test scores are fixed if the test measures a specific trait consistently in the varying circumstances that may lead to measurement errors (Kline, P. 7, 2000; Hamilton, P. 226, 2007; Coolican, P. 40, 2014).

In order to estimate the measurement errors of the two tests, mental arithmetic ability and visual working memory, the retest method was used

**Test-Retest Method**

The researchers agreed (Kline, 2005; Kaplan & Saccuzzo, 2013; Gregory, 2015) that this method is used to evaluate the error related to the application and administration of the test at two different times, and the importance of this method only emerges in measuring the traits that do not change over time, ie the neuropsychological traits. Fixed, while not suitable for constantly changing properties. This method depends on re-applying the test again to the members of the same group after an appropriate period of time Then we calculate the correlation coefficient between the scores obtained by the sample members in the first and second time, and the correlation coefficient extracted in this way is called the stability factor, that is, the stability of the test results during the period between the two applications. The results of the studies indicate that the appropriate appropriate time interval between the first and second applications should not exceed a few weeks for children and adolescents, and not exceed (6) months for adults. (Kline, P. 168, 2005; Kaplan & Saccuzzo, P. 109, 2013; Gregory, P. 105, 2015).

To achieve this, the two tests were applied to a sample of (40) male and female pupils from my school (Al-Nusour Elementary, University Flowers), and they were randomly selected from both schools equally, and after (15) days, the test was re-applied to the individuals themselves, and then the forms for the individuals' responses were corrected. The tests are based on mental arithmetic ability and working visual memory After calculating the correlation coefficient, the researcher extracted the stability coefficient between the two degrees of application by using the Pearson correlation coefficient. The reliability coefficient reached (0.762) for the mental arithmetic ability test and (0.812) for the working visual memory test.

**1- The descriptive properties of the research tools**

To know the nature of the average distribution of the research procedures, there must be some statistical characteristics or indicators such as the arithmetic mean and the standard deviation. The first is the sum of the values of the degrees divided by their number. (coolican, P. 347, 2014; Reynolds & Livingston, P.47, 2014).

As for the second, it expresses the amount of deviation of the scores from their arithmetic mean, as the closer the degree (degree of deviation) to zero, the more it indicates a convergence between the values of the distribution degrees (coolican, P. 355, 2014, Reynolds & Livingston, P. 52, 2014).

While the decrease in the values of skeweness (which searches for the concentration or distribution of scores between the positive and negative terminal values of a trait or characteristic compared to the equilibrium distribution of scores) and Kurtosis (which searches for the peak scores and the extent of their clustering in a specific range compared to the normal distribution) of the equilibrium distribution are A positive indicator of the moderate distribution of the research sample (coolican, P. 401 – 402, 2014).

**1- Final application.**

After the researcher completed the requirements for preparing the two tests, mental arithmetic ability and working visual memory, and for the purpose of achieving the objectives of the current research, the researcher applied the research tools together on the main applied research sample, which consisted of (368) male and female pupils from the primary schools of the Babil Governorate Center who continued to study for the academic year. 2021 - 2022).

**2- Statistical Means:** All statistical treatments were based on Microsoft Excel and the Statistical Package for Social Sciences (SPSS).

**The presentation and interpretation of the results**

With regard to the first objective of the research, which refers to the identification of the level of mental arithmetic ability of primary school pupils

After analyzing the pupils' answers to the mental arithmetic ability test, it was found that their scores ranged between (1-8), with an arithmetic mean of (5,728) and a standard deviation of (2.9). The achieved average is less than the hypothetical average, and to examine the statistical significance of the apparent differences between the two averages, a one-sample t-test was used, and the confirmed results

appeared in the table below. It appears from the table that the calculated t-value of (20,16) "regardless of the sign" is greater than the tabular t-value of (1.96), at the level of significance (0.05) and the degree of freedom (367), and that the negative sign means that the calculated average is It is less than the hypothetical mean of the scale, and this means that the apparent difference between the arithmetic mean of the sample and the hypothetical mean of the test is statistically significant, and since the sign is negative, this means that the level of arithmetic mental ability of primary school pupils is below the mean (Egan, P. 1551, 992).

The calculated and tabular T-test value and the statistical significance of the arithmetic mental ability test

| Participants no | Obtained mean | Standard deviation | Hypothetical mean | Degree of freedom | Calculated T-value | T-table value | Function level |
|---|---|---|---|---|---|---|---|
| 368 | 5,728 | 2,9 | 11 | 325 | 20,16 | 1,96 | function |

It appears from the above table that the calculated (T) value reached (20,16), which is higher than the tabular (T) value of (1.96) at the level of significance (0.05) and the degree of freedom (367). This means that primary school pupils have a good level of arithmetic mental ability due to the high achievement of pupils who received training on the arithmetic mental ability strategy and the increased ability to use sub-strategies for better estimation while solving problems (numerical and verbal arithmetic (the areas of problem solving and calculations). The new educational material gave these pupils an opportunity to organize their ideas, keep learning for a longer period, and choose the most appropriate strategy, which led to an increase in their performance level, in addition to helping pupilss develop thinking in the field of appreciation through those strategies and deepen their understanding, while the usual strategy (Rotation) does not give the pupils multiple opportunities to do the solving procedures for the arithmetic problem (numerical and verbal).

**The second goal / identifying the working visual memory of primary school pupils**

The results of the statistical analysis showed that the arithmetic mean of the working visual memory for all members of the research sample, which numbered (368) male and female pupils, reached (95,665) degrees, with a standard deviation of (18,843) degrees, which is greater than the hypothetical mean of the scale, which reached (40) degrees, and The results of using the t-equation for one sample showed that the calculated t-value reached (37.75) degrees, which is greater than the tabular amount of (1.96) and statistically significant at the level (0.05), at the degree of freedom (367), which indicates that The research sample has a high level of working visual memory.

T-test results to test working visual memory

| Participants no | Arithmetic mean | Standard deviation | Hypothetical mean | Calculated T- value | T-table value | Function level |
|---|---|---|---|---|---|---|
| 368 | 95,665 | 18,843 | 20 | 37,75 | 1,96 | 0,05 |

**The third objective: identifying the correlation between mental arithmetic ability and working visual memory among primary school pupils.**

To achieve the above goal, Pearson correlation coefficient was used between the pupils' scores on the mental arithmetic ability test and their scores on the visual working memory test. The calculated tr) was (23.30), which is greater than the tabular (t) value of (1.96) at the significance level (0.05) and the degree of freedom (366). This means that the educational tasks require continuous focus and mental muscle effort as it takes a lot of Time to start solving arithmetic and written problems on an ongoing basis, and the initial arithmetic operations need the ability to perceive order and sequence as represented in the process of counting.

## Conclusions

The pupils rely on their auditory and visual memory when presenting the arithmetic mental ability test. - The tests of visual working memory should be based on mathematics tests because the abilities and skills of working memory are represented in the mathematical and arithmetic abilities of pupils. The visual have the ability to control the extent from which the images emerge in their imagination and they have a quick response to translate the information into a visual system and to mentally store the visual images together.

## Recommendations

1- Using mental arithmetic (rotation, front end, harmonious numbers) in teaching positive integers and decimals and operations on them, in order to allow the pupils to use more than one strategy to solve the arithmetic problem, thus improving pupil performance and increasing his achievement.

2- Inclusion of the mathematical content of the mathematics curriculum in the intermediate stage with many mental arithmetic strategies, because the mathematics curriculum for the basic stage in Iraq lacks diversity in teaching strategies and this limits the pupil's ability to work, think and link mathematical ideas to each other within life situations.

3- Training and preparing mathematics teachers to use mental arithmetic strategies, during the implementation of the curriculum, by holding specialized courses to raise the efficiency of teachers in line with the studies of the National Council of Teachers of Mathematics in the United States, and thus this is reflected in the pupil's performance and achievement.

4- To highlight the skill of mental arithmetic as a criterion for the content of the mathematics curriculum in Iraq, since most of the previous studies indicated the importance of that.

## Suggestions

1- Conducting a study similar to this study on middle school pupils with different measuring tools, given the multiplicity of arithmetic lessons within the four operations on positive integers and decimals.

2- Conducting a study similar to this study on female public school pupils, to find out the effect of the gender variable on mathematical achievement.

3- Conducting a study similar to this study so that other strategies include mental arithmetic (such as the strategy of violating the rules of rotation, the strategy of tens and hundreds, and the strategy of the half and the multiplier for the operations of multiplication and division) to see the impact of this on mathematical achievement and the development of thinking.

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