

## Mathematical sense and its relation to the mental skills in third-grade middle school students

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### ABSTRACT

The objective of the current research is to identify the nature of the correlation between the mathematical sense and mental skills of the third-grade middle and secondary students in the middle and secondary day schools of the General Directorates of The Education of Baghdad Al-Karkh (first, second, third) and The Al-Rasafa (first, second, third) and by answering the following questions:

- 1) Do third-graders in the middle and secondary day schools of the general directorates in Baghdad have Al-Karkh (first, second, third) and Al-Rasafa (first, second, and third) have mathematical sense skills ?
- 2) Do third-graders in the middle and secondary day schools of the General Directorates of Baghdad have the skills of Al-Karkh (first, second, third) and Al-Rasafa (first, second, and third) have mental skills ?
- 3) What is the direction and strength of the correlation between the mathematical and mental skills of the third-grade middle and secondary school students of the General Directorates of Baghdad Al-Karkh (first, second, third) and Al-Rasafa (first, second, and third) ?

To achieve the aim of research and answering its questions, the following zero hypotheses have been formulated:

- 1) There is no statistically significant difference at the level of indication (0.05) between the hypothetical and mathematical averages of the third-graders in the mathematical sense test.
- 2) There is no statistically significant difference at the level of indication (0.05) between the hypothetical and mathematical averages of the third-graders in the mental skills test.
- 3) There is no statistically significant correlation at the level of significance (0.05) between the skills of the mathematical sense and the mental skills of the middle and secondary students of the middle and secondary day schools of the general directorates of Baghdad Al-Karkh (first, second, third) and Al-Rasafa (first, second, and third) .

To achieve the objectives of the research, the descriptive research methodology was adopted, the current research sample consisted of (400) students from the middle and secondary school of the general secondary schools of Baghdad al-Karkh (first, second, third) and Al-Rasafa (first, second, and third.)

To verify the objectives of the research, the researcher prepared two three-area mathematical sense test tools (Number sense, Standard sense, Statistical sense) that included twelve sub-skills, including 40 objective-type paragraphs (multiple selection), and the second mental skills test consisting of eight main skills that included twenty-one sub-skills, including 42 thematic-type paragraphs (multiple selection), and two tests on terms of honesty and consistency, and the degree of difficulty.

The two tests applied to the research sample and the results were statistically analysed using the t-test for one sample and the Pearson correlation factor, and the results resulted in:

- 1) Middle-grade students in the middle and secondary day schools of the General Directorates of Education of Baghdad al-Karkh (first, second, third) and Al-Rasafa (first, second, and third) possess mathematical sense skills.
- 2) Middle-grade students in the middle and secondary day schools of the General Directorates of Education of Baghdad al-Karkh (first, second, third) and Al-Rasafa (first, second, and third) have mental skills.
- 3) There is a positive correlation between the skills of sportsmanship and mental skills of the middle third grade students in the middle and secondary day schools of the General Directorates of The Education of Baghdad Al-Karkh (first, second, third) and Al-Rasafa (first, second, and third).

In light of the findings, the researchers recommended:

- 1) Training and qualifying math teachers through strengthening courses on the adoption of mathematical sense skills and mental skills and according to special criteria prepared for this matter and to ensure that teachers have used them when teaching students in addition to alerting math teachers to the importance of sports sense and mental skills among students as one of the important objectives of teaching mathematics.
- 2) Mental skills are important educational outcomes for students and educational institutions should strengthen them and pay attention to them as a means of developing the mathematical sense of students by changing the teaching system in schools by not using traditional methods in the provision of the subject or calendar, but the trend towards changing the sources of information and its diversity.
- 3) The possibility of generalizing the mathematical sense test and mental skills test to math teachers and urging them to adopt them in diagnosing their students' levels of mathematics before starting teaching and then using appropriate strategies, methods and methods of treatment.

The researchers also proposed several proposals:

- 1) Conduct research to uncover the relationship between mathematical sense and other variables such as: problem solving, creative thinking, inference thinking, mathematical thinking, complex thinking, complex thinking, product thinking, lateral thinking.
- 2) Building an educational program for students that enables them to acquire athletic sense and mental skills.
- 3) Conduct a pilot study to find out the impact of a teaching strategy in the development of the mathematical sense and mental skills of students.

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## Definition of Research

### First: The problem of research

The importance of mathematics and its various subjects, including the mathematical sense of its fields (Number sense, standard sense, statistical sense) in the present time and the need to deal with large numbers, measurements and statistical processes in several life situations such as sales, purchase, engineering work and statistical data has doubled, so many of those involved in the development of school mathematics have realized the challenge facing those who carry out the educational process, especially in the early stages of study, as teachers need to focus on how their students think about their athletes. , and how to learn mathematics functionally.

The problem in our schools today is the students relying on the automated application of traditional algorithms and methods and following a single formula in solutions and not encouraging them to invent new solutions, and the frequent use and reliance of calculators during the conduct of calculations conflicts with the objectives of teaching mathematics, which is to develop the ability to think mentally in students and build mental skills that enable them to use the mind and think optimally. This enables them to solve future problems, thereby achieving the interconnection between educational aims and those of daily life.

Recent years have produced tremendous developments in the field of mathematics and emerged new visions and trends that have been of interest to those who teach and learn mathematics, and that these visions and trends have been documented globally such as the documents "Curriculum and Evaluation Standards for School Mathematics", 1989 Principles and Standards for School Mathematics, 2000 by the American National Council of Mathematics Teachers (NCTM), which focused on providing students

with mathematical power, which includes mental skills as well as focused interests. on the areas of mathematical content (Number sense, standard sense, and statistical sense). These documents emphasized a review of the objectives of mathematics education and set targets that students were expected to achieve. (Badawi, 2019: 15)

Many works and activities require the individual to master many skills that show his or her activity in school activities and the accompanying tasks and duties that require students to possess many skills that help them to accomplish these activities and activities.

Because of the insufficient research achieved by the interested people in the subjects of mathematical sense and mental skills and according to the researcher learned that there is no study revealed the relationship between them, since most of the studies that dealt with the mathematical sense did not address this important segment (middle third graders) and did not receive any scientific study at the level of Iraq and the Arab region. This is why the need for current research has emerged as an attempt to identify and explore the knowledge that middle-class students have athletic sense skills as well as mental skills and knowledge of the relationship between athletic sense and mental skills. Hence the problem of current research is highlighted by the following question:

### What is the relationship between athletic sense and mental skills in middle third graders?

**Second: The Significance of research:** the Significance of the current research can be manifested in the two aspects of the first theoretical and the second applied as follows:

**Theoretical:** The Significance of this aspect is b:

- 1) The importance of the middle stage as it is an important stage in the life of students and there are more physical and mental changes than the previous stage.
- 2) Being a highlight of mathematical sense skills (Number sense skills, standard sense skills, statistical sense skills), especially since most previous studies were interested in Number sense and skills only without paying attention to other skills of mathematical sense.
- 3) Being a highlight of students' mental skills (concentration skills, information gathering skills, remembering skills, information management skills, analysis skills, obstetric skills, integration skills, calendar skills).
- 4) Provide the field of education with a mathematical sense test and mental skills test that may help researchers.

**Application:** The Significance of this aspect is b:

- 1) The possibility of taking advantage of the results of this research in the application of mathematical sense in other stages, as a preliminary experiment that can be considered to be circulated later to the rest of the stages.
- 2) Benefiting curriculum planners and developers by focusing on employing activities aimed at developing students' mathematical sense skills.
- 3) Ensure that middle-school and high school students in Baghdad province have mathematical sense skills (Number sense skills, standard sense skills, statistical sense skills).
- 4) Ensure that middle-school and secondary school students in Baghdad province have mental skills (concentration skills, information gathering skills, remembering skills, information management skills, analysis skills, Obstetric skills, integration skills, Calendar skills).

**Third: The Aim of the research:** the research aim to identify the relationship between the mathematical sense and mental skills of the third-graders.

**Fourth: Research hypotheses:** To achieve the aim of research, the following hypotheses have been formulated for testing:

- 1) There is no statistically significant difference at the level of indication (0.05) between the hypothetical and Arithmetic averages of the third-graders in the mathematical sense test.
- 2) There is no statistically significant difference at the level of indication (0.05) between the hypothetical and Arithmetic averages of the third-graders in the mental skills test.
- 3) There is no statistically significant correlation at the level of significance (0.05) between the skills of the mathematical sense and the mental skills of the middle and secondary students of the middle and secondary day schools of the general directorates of Baghdad Al-Karkh (first, second, third) and Al-Rasafa (first, second, and third).

**Fifth: Search limits:** The current search is defined by:

- 1) Middle and secondary day schools belonging to the general directorates of education of Baghdad Al-Karkh (first, second, third) and Al-Rasafa (first, second, and third).
- 2) Third-graders in the middle and secondary day schools of the General Directorates of Education of Baghdad Al-Karkh (1st, 2nd, 3rd) and Al-Rasafa (1st, 2nd, and 3rd) for the academic year 2020-2021.
- 3) Areas of mathematical sense (Number sense, standard sense, statistical sense).
- 4) Mental skills (concentration skills, information gathering skills, remembering skills, information management skills, analysis skills, generating skills, integration skills, and calendar skills).

**Sixth: Search terms:**

❖ **The mathematical sense known to:-**

- (NCTM, 1989) as an intellectual flexibility and its ability to solve diverse mathematical situations and solve sports problems and issues by understanding the relationships between them and verifying the appropriateness and reasonableness of the solution reached, in addition to possessing the

speed of intuition in solving the life problems that may face. (NCTM, 1989: 38)

- (Martin, 2009) as the development of previous knowledge and its use in new situations is done through the use of mathematics in educational situations as well as linking mathematics in life situations. (Martin, 2009: 5-6)
- The researchers adopt a definition (NCTM, 1989) and adopt a theoretical definition of it.

The researchers also know the mathematical sense procedurally as the ability of the middle third grade student to solve various sports situations and solve problems and mathematical issues by understanding the relationships between them and verifying the appropriateness and reasonableness of the solution reached and reasonableness as well as possessing the speed of intuition in solving the life problems facing him and measured the total degree obtained by the student by testing three basic dimensions of the dimensions of the mathematical sense.

#### ❖ **mental skills known to:**

- (marzano et al., 1988): those basic skills needed to employ other dimensions of thinking, they can be used in the service of post-cognition processes, critical thinking processes and creative thinking, which are means for specific purposes. (marzano et al., 1988: 86)
- (abu jado and muhammad, 2007): as "delicate and sensitive mental processes that overlap with each other when we start thinking, many of these skills have been identified, such as: remembering skills, discrimination, prediction and others. these skills are the basis for effective and effective thinking. thinking skills are used repeatedly to carry out tasks or thought processes aimed at reaching meaning, vision or knowledge. (abu jado and mohammed, 2007: 76)
- the researchers adopt the definition (abu jado and muhammad, 2007) of mental skills and adopt it theoretically.  
the researchers define mental skills procedurally as all the mental abilities and mental skills possessed by the average third grader,

through which he can process information and mathematical data to achieve different aims of remembering information, describing things, installing observations, predicting, classifying things, evaluating the directory, solving problems, and reaching results, and is measured by the overall degree of the student in the mental skills test.

## **chapter 2: a theoretical background**

### **Mathematical sense:**

New skills emerged on the educational scene in the teaching of mathematics in the early 1990s, including the skills of mathematical sense in its various fields (Number sense, standard sense, statistical sense), one of the interests of professional standards associated with school mathematics and teaching and evaluation is the interest in the mathematical sense to judge the quality of the educational process carried out by many countries, notably the United States of America. (Abdul Mohsen, 2016: 44)

The National Council of Mathematics Teachers of America (NCTM) recommended with its document entitled "Curriculum and Evaluation Levels of School Mathematics" the need to pay attention to the mathematical sense in all its fields of mathematics education, and that teachers must face the challenges of teaching the skills of the mathematical sense of students. (NCTM, 1989: 30)

The word "sense" means perception and understanding and also includes control and selection of the right ways to reach aims based on causality. (Sulaiman, 2007:109)

(Weik, 1993) is the first to refer to the concept of sense long ago in the field of management to help in management decisions and strategic planning, and did not provide (Weik, 1993) steps on how to build sense among individuals, but he gave us broad outlines about the concept of sense and how to develop it, and explained (Weik, 1993) that because of the complexity of the life in which we live there are many events and phenomena that need to be explained The sense of individuals helps to reduce the number of contradictory alternatives or vague interpretations to a less



controllable number, individuals look at the events that have occurred and try to understand and justify their actions related to these events, and when individuals draw an explanation from these events they use it to plan for the future and predict what may happen. (Weick, 1993: 10-37)

**Areas of mathematical sense:** (Number sense, standard sense, and statistical sense).

**Mathematical sense skills:**

**(Reys, B & Reys, R, 1992) noted that Number sense skills are:**

- 1) The perception of the absolute and relative quantity of number: this skill means that students understand the value of the number as an independent unit (absolute), then determine its relationship to other numbers that are small or large, in addition to determining the size of the number, the skill of students in order and sequencing from the front to the back or vice versa, and the identification of near or far numbers of a certain number, and in the fraction system students can switch between fractions and realize them as a total system, in addition to finding equal images of fractions using the number line. The significance of the number cannot be overlooked when combined with a particular unit.
- 2) Understand the relative impact of processes on numbers: each number represents a certain quantity or amount, which is known as the absolute quantity of the number, that is, that is, the number of other numbers, but if we look at how many there are in relation to you other numbers or (other numbers) here we are talking about the relative amount of the number. That is, how many are attributed to or (compared to) how many others, and students' awareness of the absolute and relative quantity of numbers includes their ability to compare and rank numbers (total, fractional, decimal) as well as their ability to perceive the distances between numbers.
- 3) Recognition and use of the distinctive Number mark: the number mark is a number chosen by students to help them make Number and numeracy judgments, for example, in order for students to realize that the collection output ( $\frac{2}{3} + \frac{5}{6}$ ) is greater than 1, they can compare

each number by number ( $\frac{1}{2}$ ) and since ( $\frac{5}{6}$ ) is greater than ( $\frac{1}{2}$ ) and ( $\frac{2}{3}$ ) is also greater than ( $\frac{1}{2}$ ) in The result of the collection of the two numbers ( $\frac{5}{6}$ ) ( $\frac{2}{3}$ ) is greater than 1 the students here have chosen the number ( $\frac{1}{2}$ ) and here it is the Number mark to compare each of the two numbers ( $\frac{5}{6}$ ) and ( $\frac{2}{3}$ ) to make it easier for them to judge whether the result is greater than one, i.e. the students have chosen the appropriate Number mark and employed it to help them make a judgment regarding the outcome of the collection of two numbers.

- 4) Awareness of mental arithmetic and approximate assessment strategies: In this skill, attention should be paid to the development of a set of flexible strategies so that students can estimate the outcomes of processes in different situations, as well as mental calculation strategies, and understand the error between assessment and mental arithmetic. There are many approximate estimation strategies (approximation, associated numbers) and mental performance strategies (renaming, fragmentation). (Reys, B& Reys,R, 1992: 114-120).

**(NCTM, 2000), (Al-Imam, 2000), (Al-Manoufi, 2002), (Badawi, 2007) indicated that the skills of standard sense are:**

- 1) Knowing the appropriate units and forming a mental image to represent them: Students who have a standard sense of knowledge of the units that fit the task and formed mental images to represent the units of measurement, the selection of a suitable unit is a key part of the understanding of measurement and this is confirmed by nctm standards regarding the measurement that educational programs from the pre-school to the secondary level should make students able to understand the characteristics of measurable things in addition to understanding the units of measurement and its systems and processes, the mental imagination of the units helps students to decide what If a centimeter, meter or kilometer is the most suitable unit for measuring the distance between home and school. (NCTM, 2000: 80)
- 2) Make a decision about measurement: students with a good standard sense have the ability to

know when to measure and when to use the estimate, most people when choosing daily clothing want a general idea of the temperature expected on this day and they do not care as accurately as to be in certain limits from (20) to (25) degrees, for example or below (20) but in disease, one degree of temperature is important to measure, i.e. in certain life matters, the estimate is It is most appropriate and in other matters the exact measurement may be the desired. (Al-Imam, 2000: 145)

- 3) Knowledge of the measurement process: The standard sense includes knowledge of the measurement process, students with a good sense of knowledge of the measurement process and have an understanding of how to measure using non-standard units and standard units, and they also have the ability to make some transfers from one unit to another with understanding the relationship between units in addition to their mastery of using tools such as: ruler, measuring tape, thermometer, protractor and other standard tools. (Al-Manoufi, 2002: 8)
- 4) Knowledge of the estimate: (Badawi, 2007) indicates that the estimate is the process of reaching the measurement without using a measuring tool, and the standard sense includes knowledge of the estimate: length, temperature, size, mass, time, etc., and the good estimate knows many methods and chooses the most appropriate ones.

**(NCTM, 2000) indicated that the skills of statistical sense are:**

- 1) Using statistical processes with understanding: understanding and correct scientific verification, awareness of statistical methods that help interpret data, develop statistical methods and procedures, and provide conclusions to solve statistical problems.
- 2) The sense of data and processes: it is intended to pay attention to the meaning and not to the quantitative description of the data, to pay attention to understanding the phenomenon and not to focus on actions by recognizing the volume of data and the relationships between them and translating them and discovering errors and inferring information, and the sense of data requires other sub-skills: to observe events expressing the phenomenon, to collect

data, to read the data in depth, and to carry out various activities around it, such as organizing and feeling the best analysis process, translating and representing it.

- 3) The sense of drawing and graphic shapes: the student's ability to read drawing and graphs with understanding and depth, translate graphs into numbers and words, infer what the drawing says, discover existing errors, and also complete the missing objects in the drawing.
- 4) To judge the reasonableness, predictability and generalization of the results: to know, understand and understand the reasonableness of the results, also to discover the mistakes that may have occurred, and to try to make convincing judgments that can be used in other situations. (NCTM, 2000 :32)

### Mental skills

Here is an explanation of each mental skill:

**First: Focus skills:** Under these skills, students are directed to understand the problem through specific stimuli from their thinking environment, including two sub-skills:

- 1) Problem identification skill: Questionable situations are clarified and solutions are found.
- 2) Aim-setting skill: Work to identify the educational outcomes expected to be reached after students have passed through educational-learning experience. (Marzano et al., 1988: 72-70)

**Second: Information-gathering skills:** skills used to collect the relevant or problem material for use in the cognitive process, and are represented by two sub-skills :

- 1) Note: "The observation here means the use of one or more of the five senses (vision, hearing, taste, smell, touch) to obtain information about the object or phenomenon on which the observation lies, a thought process that includes observation, observation and cognition, and is usually associated with a strong cause or purpose that requires attention and accuracy of observation". (Groan, 2013: 137)
- 2) Drafting questions: "A skill that involves clarifying issues and meanings through the

approach of the survey, good questions are directed towards important information, and are formulated with the aim of generating new information. (Al-Absi, 2019: 223)

**Third: Remembering skills:** strategies or activities that are deliberately used in long-term memory and are retrieved later when needed and include two skills :

- 1) **Codecoding skill:** The process by which small parts of knowledge are linked to each other and kept in long-term memory. (Abu Jado and Muhammad, 2007: 87)
- 2) **Recovery skill:** An intellectual skill through which the previous information is summoned in long-term memory. (Marzano et al., 1988: 77)

**Fourth: Organizing skills:** organizing and arranging information to make it easier to understand in a more effective way and include the following skills :

- 1) **Comparison:** "This is a skill that is used to examine two things, two ideas or two positions to discover similarities and points of difference, and to define it from the point of view of students, is that skill that looks for ways where things are similar and different (Saade, 2009: 201)
- 2) **Classification:** "This skill refers to working on the compilation of paragraphs and vocabulary on the basis of their critical characteristics, or working on putting vocabulary into groups based on their common characteristics (Abu Jado and Muhammad, 2007: 89)
- 3) **Ranking:** "Is a skill that involves subjecting elements or vocabulary to organization according to a particular criterion (Al-Hawiji and Mohammed, 2012: 67)
- 4) **Representation:** "Is to reformulate and express information in a way that shows important relationships in its elements by transforming it into diagrams, charts, tables or graphic problems (Al-Rubaie et al., 2013: 126)

**Fifth: Analysis skills:** through which information is explained by examining it and recognizing the relationships it contains and the following skills:

- 1) **Identifying attributes (characteristics):** It is intended to distinguish between objects and to identify their characteristics and parts that identifying features and components requires the individual to know, and to clarify the parts that are together. (Marzano et al., 2004: 206)
- 2) **Identify relationships and patterns:** "It is intended to identify the methods that bind the components (Groan, 2013: 53)
- 3) **Identifying key ideas:** "It means being able to understand the function of the part and its relationships with other parts (Obeidat and Suhaila, 2007: 92).
- 4) **Error identification:** "This skill is based mainly on error detection during a logical presentation that includes a set of calculations, procedures and information". (Abu Jado and Muhammad, 2007: 98)

**Sixth: Obstetric skills:** using previous knowledge in order to obtain information beyond what is given and includes the following skills:

- 1) **Inference:** "This skill is intended to identify and provide the necessary elements to extract the logical results of the intended or actual inference relationships from the terms, attributes, questions or any other form of expression (Al-Hawiji and Mohammed, 2012: 70)
- 2) **Prediction:** The ability of the individual to build predictions related to future events based on his or her information and new ideas. (Al-Atum et al., 2014: 245)
- 3) **Expansion:** "This skill means the ability of the learner to provide more details, explanation and information related to previous knowledge and the importance of the skill of expansion comes by generating a mental image or new language that works to link the new to what is available in the cognitive construction of the learner (Al-Hawiji and Mohammed, 2012: 71)

**Seventh: Integration skills:** arranging the parts that exist in common relationships with each other in order to lead to a deeper understanding of those relationships and include the following skills :

- 1) **Summary:** "It is a thought process that includes the ability to find the point of the topic and extract the main ideas in it and

express them briefly and clearly (Groan, 2011: 175)

- 2) Reconstruction: "It is a process of changing the cognitive structure directed to integrate new information as the teacher, as the teacher, according to the new things, is actively aiming to modify, expand or reorganize the material that is learned for students in order to abandon the previous concepts, and the formulation of ideas is a key part of the process of cognitive development, i.e. changing the structure of knowledge that exists to be integrated with new information (Ghanem, 2009: 240)

**Eighth: Evaluation skills:** assessing the quality of the ideas he has come up with are the following skills:

- 1) Building standards: "It is a set of testing to judge the value and quality of ideas". (Al-Hawiji and Mohammed, 2012: 74)
- 2) Confirmation: By which we mean to confirm the accuracy of the claims made about a case using the criteria or the testes of the calendar (Marzano et al., 1988: 117)

### Previous Studies

**The first axis: studies on mathematical sense:**

**1) Felle study, shaimaa saied al-saied (2014):**

It aimed to know "the effectiveness of the use of strategies beyond knowledge in the development of sports sense in primary school students", conducted in Egypt.

**2) Abdul Mohsen Study, Wala Atef Mohammed Kamel (2016):**

It aimed to know the effectiveness of a program based on some self-organized learning strategies in teaching mathematics to develop the skills of creativity and athletic sense in middle school students", conducted in Egypt.

**3) Al-Mursi Study, Basma Al-saied Ibrahim (2017):**

It aimed to know the "effectiveness of teaching using Vedic Mathematics in the development of mental arithmetic and athletic sense in middle school students", conducted in Egypt.

**4) Khattab Study, Ahmed Ali Ibrahim Ali (2019):**

It aimed to know "the effectiveness of a proposed training program based on the life applications of mathematics for community education school

teachers in the development of their sense of athleticness and teaching performance", conducted in Egypt.

**The second axis: studies on mental skills:**

**1) Muhammad Study, Jamal Hamad Abdul Wahab (2014):**

It aimed to find out "the effectiveness of using the Universal Concept of Mental Arithmetic System (UCMAS) in the development of mental skills among elementary students in Khartoum State (Sudan). Conducted in Sudan.

**2) Al-Fatli Study, Samah Abdul Karim Abbas (2015):**

It aimed to know "Fishbowl Strategy and its effectiveness in developing the mental skills of the students of the Physics Department and their academic education", conducted in Iraq.

**3) Al-Chalabi Study, Mohammed Khalid Abdul Rahman (2017):**

It aimed to find out the effectiveness of both Ishikawa's strategy and the one-minute paper strategy in the achievement of middle-class students of chemistry and mental skills, conducted in Saudi Arabia .

**4) Al-Saadi Study, Amir Muhammad Ali Rasul (2019):**

It aimed to know the "effectiveness of the model to accelerate thinking about the acquisition of biological concepts in middle second graders and their mental skills", conducted in Iraq.

### Research Methodology and Procedures

**First: The research Methodology:** the researchers adopted the descriptive research approach, because it is suited to the nature of the research and its objectives.

**Second: Research Population:**

- 1) **School Population:** The number of middle and secondary schools for boys and girls in the Baghdad al-Karkh/Al-Rusafa directorates for the academic year (2020-2021) is 1056, of which 486 middle and secondary schools for boys represented a ratio of (46%) From the school Population, 452 middle and secondary schools for girls accounted for 43 percent of the total. It was excluded in the selection of the basic sample of research, including (118) mixed schools representing a percentage of (11%) They were also excluded in the selection of the basic sample of research.



2) **Student Population:** The current student Population of (82,859) middle-class third-graders is distributed to (486) of the six general directorate schools of education in Baghdad province al-Karkh (first, second, and third), al-Rusafa (first, second, and third) for the academic year (2020-2021).

**Third: The research sample:** The researchers adopted the random stratified sample, "which is the sample that is chosen from a community of origin divided into layers or segments, each of which expresses the level (or category) of the levels (or categories) of the subject of the research as it represents those layers or segments in the selected sample (Al-Bassiouni, 2013: 319)

- )
- a) **Sample the clarity of the instructions and the wording of the paragraphs:** the researchers chose (40) students from the Middle Of Uqba bin Nafi for boys of the Directorate of Education of Baghdad Al-Karkh II, To apply the research tools (mathematical sense test, mental skills test) to identify the clarity of the paragraphs and to see if there are vague paragraphs as well as to determine the time needed to answer the paragraphs of the research tools, the researcher found through discussion with the sample members that the instructions for answering, paragraphs and alternatives were clear, and the time taken to answer the search instruments ranged from (90-150) minutes to an average of (120) minutes.
- b) **Statistical analysis sample:** After identifying the research community, the researchers relied on the special equation in determining the sample size for the purpose of conducting statistical analyses of the research data (Afana, 1997: 325)

The sample of 400 students close to the result was 398.078286 after relying on a level of indication (0.05) in the current research .

A simple random sample of students representing each of the six directorates was selected based on their own equation (Fleifel and Fathi, 2013: 16)

**Fourth: The two research Instrument:** were the two tests, the first is the test of mathematical sense

and the second is the test of mental skills, and the mechanism of building each of them was as follows:

- 1) **Determining the objective of the two tests:** The two tests aim to measure both the skills of the mathematical sense and mental skills within the skills specified for each, which are suitable for the middle third grade students in the middle and secondary day schools of the general directorates of the education of Baghdad Al-Karkh and Al-Rasafa.
- 2) **Identifying the skills of the two tests:** The researchers relied in determining the skills of mathematical sense and mental skills on educational literature and consulting a number of arbitrators in the field of mathematics and methods of teaching them, as follows:
  - a) **Mathematical sense skills:-** (understanding the absolute and relative quantity of numbers, recognizing the relative impact of processes on numbers, recognizing and using the characteristic Number marker, recognizing and using the strategies of mental calculation and estimation, knowing the appropriate units and forming a mental image to represent them, deciding on measurement, knowing the measurement process, knowing the measurement, using the statistical processes with understanding, sense of data and processes, a sense of graphic and graphic, judging the reasonableness of the results and predicting and generalizing them).
  - b) **Mental skills:-** Namely (identifying problems, setting aims, observation, drafting questions, decoding, retrieval, comparison, classification, ranking, representation, identifying attributes, defining relationships and patterns, identifying key ideas, identifying errors, inference, forecasting, expansion, summary, rebuild, build standards, and ascertain).
- 3) **Presentation of skills to a number of arbitrators:** after identifying the skills of sportsmanship and mental skills were presented to a number of arbitrators in the field of teaching methods of mathematics and psychology, to indicate their opinions on the suitability of the research sample and in the light of their opinions and by a percentage of agreement (85%) Moreover, the researchers

identified mathematical sense skills and the right mental skills for research.

- 4) **Determining the scientific material for the two tests:** the scientific material that will be the paragraphs of the two tests was determined by looking at the content of the scientific subject of mathematics for middle school and other sources useful in this aspect.
- 5) **The drafting of the paragraphs of the two tests:** the paragraphs of the two tests were drafted, as the researchers prepared (40) paragraphs to test the mathematical sense, while the researchers (42) prepared a paragraph for a test of mental skills and the researchers used to draft two test paragraphs of the objective type and each test paragraph was given four alternatives, one of which is correct and the other alternatives are wrong.
- 6) **The formulation of the instructions for the two tests:** the instructions of the two tests were formulated, as they included the objective of the two tests, what is required of the students, how to answer the questions, and the researchers took into account that the instructions are clear and understandable to the students as I explained to them that their degree on these tests is for the purposes of scientific research.
- 7) **Apply the two tests to the information sample and the statistical analysis sample:**
  - a) **Application to the sample of information:** The mathematical sense test was applied in its initial form on (Monday) 30/11/2020, and the mental skills test was applied in its initial form on (Tuesday) 1/12/2020 on the same sample of the third-graders of the middle grade consisting of (40) students, selected from non-final sample, The aim of this application was to know the possibility of students answering the paragraphs of the two tests and to determine the time of the students to finish the first five students, the ambiguity of some paragraphs or the double understanding of either part of the tests and to find the ratio of the average time allocated to the instructions was recorded and the average time was 10 minutes. While for mental skills testing was (100-140) minutes, the average time was 120 minutes.
  - b) **Application to the statistical analysis sample:** After applying the mathematical

sense and mental skills tests to the sample of information and making appropriate adjustments to the two tests and verifying the applicability of the tests and the clarity of their instructions and determining the time for each through the initial exploratory sample, The two tests are ready to be applied to the statistical analysis sample of (400) middle-class students in the middle and secondary day schools of the General Directorates of Baghdad Al-Karkh (first, second, third) and Al-Rasafa (first, second, and third), and the aim of these tests was to conduct statistical analyses of the paragraphs of the two tests.

- 8) **Correct the two tests:** The researchers developed typical answers for the paragraphs of the two tests and presented to a number of arbitrators in mathematics and methods of teaching them, and to ensure that they represent the typical answers depending in the correction the correcting of the two tests were prepared to clarify the correct answer for each of the two paragraphs, and allocated one score for the correct answer for the paragraph and zero to the wrong answer to the paragraph or left unanswered or the paragraph for which more than one alternative was chosen, The mathematical sense test (40) included a thematic paragraph of the type (multiple choice) and each paragraph four alternatives, one of which is correct and the remaining alternatives wrong, the overall test score is (40) scores, and the mental skills test (42) includes objective paragraphs of the type (multiple choice) and each paragraph has four alternatives, one of which is correct and the remaining alternatives are wrong, and the overall test score is (42) degrees.
- 9) **The Psychometric Properties of the two tests:** the validity, reliability and method of construction of the tool (Abu Allam, 2009: 50 )
  - 1) **The validity of the two tests:** two types of honesty have been found and as follows:
    - a) **Virtual honesty:** The two tests were presented as preliminary to a number of judges in the field of mathematics and their teaching methods to verify the validity of the paragraphs in each area, the suitability of the paragraph for the field you measure and the test as a whole, the modification of paragraphs

that need to be amended in addition or deleted. Agreement rate (86%) And more.

**b) The construction of the two tests was verified:** the construction authenticity of the two tests has been verified in the following ways:

- 1) The coefficient of correlation of each paragraph's grades with its own field grades:** Pearson's correlation coefficient was adopted in order to find the coefficient of correlations between the score of each paragraph and the degree of its field, and the results in the mathematical sense test ranged from (0.450 - 0.837) \*\*, while in the mental skills test the results ranged from (0.393 - 0.847) \*\* i.e. indicating the internal consistency of the two test paragraphs.
- 2) The correlation coefficient between the scores of each field and the overall test score:** the correlation coefficient between the scores of each field and the total test score was adopted by the pearson correlation coefficient, and all correlation coefficients were found to be statistically significant, ranging in the mathematical sense test from (0.532 - 0.836) \*\*, while in the mental skills test between (0.555 - 0.830) \*\*.
- 3) The correlation coefficient between the grades of each paragraph and the overall test score:** the correlation factor between the grades of each paragraph and the total test score was adopted by the pearson correlation coefficient, as all correlation coefficients were found to be statistically significant, ranging in the mathematical sense test from (0.316 - 0.600) \*\*, while in the mental skills test between (0.294 - 0.559)\*\*.
- 2) Reliability of the two tests:** The reliability factor value of the mathematical sense and mental skills tests applied to the statistical analysis sample was calculated according to the K-R20 formula equation (K-R20), which is based on the application of the test at once and can be used to verify the homogeneity of all test paragraphs that measure a single attribute or attribute and are bi-class (0.1), as it is used to calculate the reliability of the two multi-paragraph tests by utilizing the difficulty and ease factor for each paragraph of the test. The variance of the vertebrae is calculated from the

result of multiplying the difficulty factor in the ease factor (Mahasina, 2013: 134-135)

The reliability of the mathematical sense test (0.87) and the reliability of the mental skills test (0.88), indicates (Allam, 2000) that the value of reliability if it reaches (0.80) and above is high value of reliability (Allam, 2000: 543)

**10) Statistical analysis of the two test paragraphs:** after completing the correction of the answers, i.e. the highest percentage (27%) Of the highest score, the lowest percentage (27%) Of the lowest scores, the number of students in each group was 108.

**The statistical analyses of the two tests are as follows:**

**a) The difficulty and ease factor of the paragraphs:** The purpose of calculating the difficulty factor of the paragraphs is to select the appropriate paragraphs and delete the very difficult paragraphs or the easy paragraphs (Al-Zubai et al., 1981: 77)

The difficulty factor represents the percentage of students answering the question wrongly for the paragraph of the total number of participants in the test in the corrected grade of the test (Jaber, 1983: 42)

The difficulty coefficients for the mathematical sense test, which ranged from 0.40 to 0.60, were calculated within acceptable limits, while the difficulty coefficients for mental skills testing ranged from 0.40 to 0.69, and were within acceptable limits, indicating that the paragraph was good if its difficulty ranged from (0.40-0.70) (Al-Menzel and Adnan, 2019: 155)

**b) The strength of the distinction of paragraphs:** A distinction factor was calculated for each paragraph of the two test paragraphs and according to what is found in its discrimination coefficient equation and was found to range from (0.41 to 0.69) in both tests, and the paragraphs are very good as (Al-Mayahi, 2011) indicated that the paragraph was very good as the coefficient of excellence (0.40) or more (Al-Mayahi, 2011: 181)

**c) The effectiveness of alternatives (dispersors or camouflagers):** The effectiveness of the wrong alternatives for each of the two test paragraphs was calculated according to the effectiveness of their faulty alternatives, and

was shown to range from  $[(-0.09) - (-0.25)]$  to the mathematical sense test, while in the mental skills test they ranged from  $[(-0.10) - (-0.23)]$  meaning that those wrong alternatives have distracted students at a low level of testing.

#### **Fifth: The final application of the two tests:**

The two tests were applied to the sample of research consisting of (400) students from Wednesday, December 22, 2020 to Thursday, 17/12/2020, which included six schools belonging to the directorates of education in Baghdad, where the results of the sample of statistical analysis were adopted as results of the basic sample in order not to delete any paragraph of the two tests during the statistical analysis.

**Sixth: Statistical means:** The researchers used many statistical methods in the analysis of current research data including (equation of difficulty of paragraphs, equation of the distinction of paragraphs, equation of the effectiveness of the wrong alternatives, Pearson correlation coefficient, K-R20 equation, t-test, equation of finding sample size, equation of finding the number of elements representing the layer in the sample) as the researchers used the Statistical Bag of Social Sciences (SPSS) 22 version.

### **Search Results**

#### **First: View and interpret search results:**

##### **Results related to search aims:**

#### **1) The first question: Do the students of the middle and secondary grades of the general secondary schools of Baghdad Al-Karkh**

Sample	Average arithmetic	Standard deviation	Hypothetical average	t-test	Level of significance	Degree of freedom	Indication at 0.05
400	21.62	8.28	20	3.92	0.000	399	Function

The researchers explain this finding:

Although the average sample is higher than the hypothetical average and the value is statistically significant, this value was not significantly higher and the average sample arithmetic indicates that the average third-grade students have a mathematical sense and this may be due to:

- 1) The role of teaching methods by teachers in schools has led to the development of a sense of sportsmanship among students .
- 2) Increase students' experience associated with sense of sportsmanship and its components.
- 3) Students with good knowledge levels.

#### **(first, second, third) and Al-Rasafa (first, second, and third) possess the skills of mathematical sense ?**

The researchers derived from this question the following zero hypothesis:

**There is no statistically significant difference at the indicative level (0.05) between the hypothetical and mathematical averages of the grades of the third-grade average in the mathematical sense test.**

The computational average of the 400 research sample members in the mathematical sense test was calculated (21.62) while the hypothetical average was (20), and by comparing the computational average and the hypothetical average, it was found that the level of indication (0.000) was lower than the approved indication level (0.05), which means that the research sample students have mathematical sense skills because the difference is statistically significant. (Mohammed, 2016: 30)

That is, there is a significant difference at the level (0.05) and in favor of the mathematical average of the test and this leads us to reject the zero hypothesis, i.e. there is a statistically significant difference at the indicative level (0.05) between the arithmetic average and the hypothetical average (20) on the mathematical sensory sensor test, as shown in the table.

Table. Computational average, standard deviation and Calculated T value for study sample students in the mathematical sense test

- 4) The ability of students to employ examples and mathematical applications in new situations within the mathematical sense.

#### **2) Question 2: Do the middle-school third-graders in the middle and secondary day schools of the General Directorates of The Education of Baghdad al-Karkh (first, second, third) and Al-Rasafa (first, second, and third) have mental skills ?**

The researchers derived from this question the following zero hypothesis:

**There is no statistically significant difference at the indicative level (0.05) between the**



### hypothetical and mathematical averages of grades of the third-grade middle class in the mental skills test.

The computational average of 400 students in the mental skills test was calculated (22.04) while the hypothetical average was (21), and by comparing the computational average and the hypothetical average, the indicative level (0.019) was lower than the approved indication level (0.05), which meant that the research sample students had mental skills because the difference was statistically significant. (Mohammed, 2016: 30)

That is, there is a significant difference at the level (0.05) and in favor of the mathematical average of the test and this leads us to reject the zero hypothesis, i.e. there is a statistically significant difference at the indicative level (0.05) between the arithmetic average and the hypothetical average (21) on the mathematical sensory sensor test, as shown in the table.

Table.Computational average, standard deviation and calculated T value of the research sample in the mental skills test

Sample	Average arithmetic	Standard deviation	Hypothetical average	t-test	Level of significance	Degree of freedom	Indication at 0.05
400	22.04	8.80	21	2.36	0.019	399	Function

Thus rejecting the second hypothesis and this result can be explained: the mathematical average of the sample indicates that middle-grade students have mental skills and the researcher may attribute this to:

- 1) Mathematics lessons develop mental skills as the value of the numeric average was high for the sample.
- 2) The intermediate third stage has contributed to the advancement of their mental skills.

### 3) Question 3: What is the direction and strength of the correlation between the mathematical and mental skills of the middle and secondary third-grade students in the middle and secondary day schools of the General Directorates of The Education of Baghdad Al-Karkh (first, second, third) and Al-Rassafa (first, second, and third) ?

The researchers derived from this question the following zero hypothesis:

**There is no statistically significant correlation at the level of significance (0.05) between the mathematical and mental skills of the middle and secondary school students in the middle and secondary day schools of the General Directorates of The Education of Baghdad Al-Karkh (first, second, third) and al-Rasafa (first, second, and third).**

When answering the third question, the results showed that the mathematical average of the

sample in the mathematical sensor test was (21.62) with a standard deviation (8.28) and that the average sample in the mental skills test was (22.04) and standard deviation (8.80) and when using a correlation coefficient Pearson to detect the relationship between the two research variables in students it turns out that the correlation coefficient was (0.90) which is d at the level of indication (0.05), which is a very high positive correlation relationship because the values of the correlation coefficients range between (0-1) and the closer their values are to (1) the correlation coefficients are strong , it is a very positive correlation relationship because the values of correlation transactions are very strong, and this indicates a relationship between the skills of the mathematical sense and the mental skills of the students of the research sample, i.e. the increased ownership of the skills of the mathematical sense increases their possession of mental skills and vice versa, as described in the table.

Table. The coefficient of correlation between mathematical sense skills and mental skills and the correlation to the research sample as a whole

Test	Sample size	Average arithmetic	Standard deviation	Link coefficient	Level of significance	Indication
Mathematical sense	400	21.62	8.28	0.90**	0.000	Function
Mental skills	400	22.04	8.80			

The third zero hypothesis is therefore rejected and this result can be explained as follows:

- 1) The mathematical sense is a kind of thinking that depends on careful meditative thinking and depends on the logical foundations in calculating the numbers and knowledge of measurements and statistical data and then issuing mathematical judgments based on the foundations of the holistic treatments and that mental skills are also dependent on the types of inductive thinking and judgments and meditative thinking so the relationship between them was very high and moral function.
- 2) The mathematical sense can be developed by acquiring experience and practice as well as mental skills, and years of study have contributed to exposing students to many educational positions that have helped in the development of athletic sense and mental skills so the relationship was very high and function.

**Second: Conclusions:** In light of the results of the current research, it is possible to conclude the following:

- 1) middle-grade students in the middle and secondary day schools of the General Directorates of Education of Baghdad al-Karkh (first, second, third) and Al-Rasafa (first, second, and third) possess mathematical sense skills.
- 2) middle-grade students in the middle and secondary day schools of the General Directorates of Education of Baghdad al-Karkh (first, second, third) and Al-Rasafa (first, second, and third) have mental skills.
- 3) there is a positive correlation between the skills of sportsmanship and mental skills of the

middle third grade students in the middle and secondary day schools of the General Directorates of The Education of Baghdad Al-Karkh (first, second, third) and Al-Rasafa (first, second, and third).

**Third: Recommendations:** In light of the results, the researchers recommended the following:

- 1) Training and qualifying math teachers through strengthening courses on the adoption of mathematical sense skills and mental skills and according to special criteria prepared for this matter and to ensure that teachers have used them when teaching students in addition to alerting math teachers to the importance of sports sense and mental skills among students as one of the important objectives of teaching mathematics.
- 2) Mental skills are important educational outcomes for students and educational institutions should strengthen them and pay attention to them as a means of developing the mathematical sense of students by changing the teaching system in schools by not using traditional methods in the provision of the subject or calendar, but the trend towards changing the sources of information and its diversity.
- 3) The possibility of generalizing the mathematical sense test and mental skills test to math teachers and urging them to adopt them in diagnosing their students' levels of mathematics before starting teaching and then using appropriate strategies, methods and methods of treatment.

**Fourth: Proposals:** As the researchers have proposed several proposals, they are as follows:

- 1) Conduct research to uncover the relationship between mathematical sense and other variables such as: problem solving, creative thinking, inference thinking, mathematical

thinking, complex thinking, complex thinking, product thinking, lateral thinking.

- 2) Building an educational program for students that enables them to acquire athletic sense and mental skills.
- 3) Conduct a pilot study to find out the impact of a teaching strategy in the development of the mathematical sense and mental skills of students.

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