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Visual Intelligence and its Relationship to Cognitive Preference in Science Among Intermediate School Students

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Abstract

The objective of this study is to identify the level of visual intelligence and its relationship to cognitive preference in science among intermediate school students. The current research was limited to a sample consisting of (150) in the governmental day schools affiliated to the Directorate of Education of Diwaniyah from the morning study. for the academic year (2022-2023), they were deliberately selected, and based on a proportional distribution. The researcher used the descriptive correlational research method, and to achieve the goals of the research, the researcher prepared two tools, the first tool (visual intelligence test), which in its final form consists of (15) items of the type (multiple choice) with three alternatives, The apparent validity and validity of the content were verified, and the difficulty coefficient, the discrimination coefficient, and the effectiveness of the alternatives for the objective items were extracted, and the stability of the test items was found using the internal consistency method (alpha-Cronbach coefficient). It reached (0.80), and the second tool (cognitive preference scale), which in its final form consists of (18) items distributed equally with three alternatives (always-sometimes-rarely) on the domains, namely:

The capacity for retention, meaning, linking, derivation, synthesis, the property of multiple modes of cognitive representation, and its apparent validity and constructive validity were verified, and the discriminatory powers of its paragraphs, and its stability was calculated using the internal consistency method (alpha-Cronbach coefficient), as the stability coefficient reached (0.77), The psychometric properties of the paragraphs of the two scales were confirmed to be ready for the final application, and the statistical bag for social sciences (SPSS) was used in data processing,

and the research found a correlation between visual intelligence and cognitive preference.

Keywords: visual intelligence - cognitive preference.

Chapter One: Introduction

First: Statement of the problem

The educational learning process faces many challenges and problems in light of the development taking place in all aspects of life, especially the rapid development in science.

This in itself requires specialists in this field to develop visual intelligence among students based on the scientific curriculum of science, which contains scientific images that raise the level of intelligence and cognitive preference among students. Through what the researcher touched with his modest experience of (15) years in teaching, especially science, There is a decrease in their scientific level, and a weakness in visual intelligence, and if it exists, it is little, i.e. it does not rise to the required level, which resulted in a lack of most students in the intermediate stage, and this is what was found by local studies such as a study (Al-Khuzai, 2012) and a study (Al-Masoudi and Mona, 2021).). This was confirmed by a number of science teachers who have an experience of not less than (5) years in the field of teaching and supervisors of specialization in science, whom the researcher deliberately contacted by submitting a questionnaire to them. cognitive,

They also confirmed, through the questionnaire provided to them, that they are not satisfied with the level of visual intelligence of the students in the second-grade average, and through all these indicators, the research problem was crystallized by the researcher, to answer the following question: What is the relationship between visual intelligence and cognitive preference? in science for intermediate school students?

Second: The importance of the research

The current research can be summed up in the following points:

- It is considered the first local research (as far as the researcher knows) to deal with the variable of visual intelligence and cognitive preference in the intermediate stage.

- The research is determined by the importance of the target group as an important stage in building the student and developing his arguments, inclinations and abilities through the visual side.

- The importance of recognizing the aspect of cognitive preference among students may contribute to taking into account individual differences among students.

- The research sheds light on the importance of visual intelligence, being one of the types of intelligences that deals with higher skills, which gives - an understanding of cognitive information and the completion of the mental image such as drawings, pictures and diagrams in the textbook, and linking what they learn in scientific life.

- Those in charge of the curricula, supervisors, and specialists may benefit by holding seminars, courses, and workshops to address visual intelligence and cognitive preference.

Third: Research Objectives

This research aims to:

1) To identify the level of visual intelligence among intermediate school students.

2) To identify the level of cognitive preference among intermediate school students.

3) The correlation between visual intelligence and cognitive preference among intermediate school students.

Fourth: Limitations of the research

The current research is limited to:

1- Students of the second intermediate grade in the Hammurabi Intermediate School for Boys affiliated to the General Directorate of Education of Diwaniyah / Center.

2- The academic year (2022-2023 AD).

Fifth: Definitions of key terms

1- The visual Intelligence

(Al-Khafaf, 211) “The ability to perceive the visual-spatial world in a mental and tangible way, and this type of intelligence deals with the sense of sight, where the individual is able to visualize an object and form images and internal perceptions, it is possible to identify this type of intelligence in individuals by responding to colors with the ability to visualize things and synthesize them, and even it can be said that they are imaginative and have a developed sense of understanding directions and they love books that contain many pictures. (Al-Khafaf, 2011, 73-74).

(Nofal, 2007) “It is the ability to visualize spatial visualization, coordinate spatial images, and perceive three-dimensional images, in addition to artistic creativity based on fertile imagination.”

This type of intelligence requires a degree of sensitivity to color, line, shape, nature, field, and the relationships that exist between these elements.” (Nofal, 2007: 101).

Cognitive Preference

(Al-Basri 2007) “Mental operations that show the way the student deals in organizing his awareness of what is going on around him in the external world and in the way he deals in different social situations and preferential to a certain pattern in dealing with them” (Al-Basri, 2007: 63).

(Al-Zaghoul, 2009) “The way individuals perceive external situations and incidents, and the way they think about such situations.” (Al-Zaghoul, 2009: 33).

Chapter tow: (Theoretical Framework and Previous Studies)

The first axis: The Visual Intelligence

Intelligence and Wechsler 1939 define it as “the total ability of the individual to act purposefully and think rationally and successfully with the environment.” (Al-Faqa’awi, 2016, 15).

Howard Gardner defined intelligence as "the ability to solve problems, or create products that have value in one or more cultural environments."

And Gardner defined it again as "the latent biological ability to process information that can be activated in a cultural environment to solve problems or create products that have some cultural value" (Shawahin, 2004, 1).

In the light of Gardner's definition of intelligence, we can say that intelligences are not things that can be seen or can be counted, but are capabilities that are supposed to be neural potentials that may or may not be activated, depending on cultural values, available opportunities, and decisions taken by the individual, his family, and his teachers, and he defined the concept of intelligence with the following points:

- The ability to solve problems .

- The ability to innovate new solutions.

- The ability to place something in, or to pursue beneficially that has value within one's culture. (Atiyah: 2009, 296).

This type of intelligence involves sensitivity to color, lines, shape, space, and the relationships between these elements. It includes the ability to visualize, spatial representation of visual or spatial ideas, and the ability to orient oneself appropriately within a visual spatial template. (Armstrong, 2006: 2).

This type of intelligence is not limited to the visual fields, as Gardner noted that spatial intelligence is also available in children deprived of the grace of sight, as spatial reasoning for the blind replaces linguistic reasoning for the sighted. (Younes et al., 2004: 55).

This type relates to the ability to visualize the relative position of objects in space. It is especially apparent in people with artistic abilities such as painters, interior designers, architects and navigators. (Affana and El Khazindar, 2007: 73) that the mental abilities or intelligences of a person are multiple and a person may enjoy more than one type of these mental abilities in different proportions, as we may find a person with visual-spatial intelligence But he does not have social intelligence, in the sense that mental abilities are distributed and not necessarily all available in the same person by examining the researcher about the various types of intelligences, he found that visual / spatial intelligence is closely related to biology, as it is the science of imagination, visualization, plans and shapes (Al-Shibawi, 22, 2012). (Gardner, 2000) explained that these

intelligences, although they are anatomically separate from each other, rarely work independently. This intelligence includes sensitivity to color, line, shape, nature, field or space, and the relationships that exist between these elements. It includes the ability to visually depict, and to represent an individual and graphically depict visual or spatial ideas. (Jaber, 2003: 11). Jaber 2005 describes people with visual intelligence as follows:

-Tells and describes clear visual images.

- Reads maps, paintings and diagrams more easily than reading text.

-He daydreams more than his peers.

-He enjoys art activities.

- He draws shapes advanced for his age.

- Likes to watch animated movies, slides and other visual shows.

-Enjoys solving puzzles, riddles, mazes, and other similar visual activities.

- Builds interesting buildings with three dimensions better than those of his age. (Jaber, 2005: 33).

Strategies for teaching visual intelligence:

The cave drawings of prehistoric man witness and evidence that spatial learning or learning shapes and drawings was important to humans from a long time ago. Unfortunately, the idea of presenting information to pupils through visual images and audio formats in today's schools, it is sometimes translated into writing on the board and an exercise of a linguistic nature. Spatial intelligence responds to images, either as an image in one's mind or as an image in the outside world; Photographs, slides, animations, graphic illustrations, ideographic languages. The following are five teaching strategies designed to activate students' spatial intelligence. (Jaber, 2003: 94-95).

1. Visual imagination strategy: One of the easiest ways to help students translate the book and lecture material into pictures is for the student to close his eyes and imagine what he studied. One application of this strategy requires students to create their own indoor sport (or a movie or television screen in their minds). Then they can put on this mental board any subject they need to remember, spelling words, math formulas, and as

the pupils are asked to retrieve specific information they then need to just recall from their mental board and “see” the data written on it. There is also another method for this strategy, and it includes that the students close their eyes and see pictures of what they have finished reading or studying (for example, a story or a chapter in a textbook).

Afterwards they can draw or talk about their experiences, and teachers can also lead pupils in formal or formal guided picture sessions. More so, as a way of introducing them to new concepts or material (e.g., leading them on a 'guided journey' through the circulatory system to learn anatomy) and pupils may also tell non-pictorial (spatial) content during these activities (e.g., motor visualizations, verbal visualizations or musical visualizations). Armstrong, 2006: 74).

2. Color alerts strategy

High sensitivity to colors is often one of the characteristics of students who have high spatial intelligence. It is noticeable today that the vocabulary is full of texts written in black and white whether in textbooks or even writing on the board. There are many creative ways to introduce different colors into the classroom as a learning tool, as the teacher can use different colors of chalk, pens, and transparencies. (Nofal, 2007: 215).

3. Image metaphor (metaphor) strategy: metaphor is the use of one idea to refer to another idea, and the image metaphor expresses one idea visually to another. And metaphorical images express an idea in a visual form, and developmental psychologists suggest that young children are masters of metaphor and metaphor. Unfortunately, this ability often diminishes as children grow older, but educators can reach this latent potential (using a metaphor). To help them master new material. The educational value of the metaphor lies in the formation of connections between what the student already knows and what is presented to him or is presented to him. Think about the main point or concept that you want your students to master. Then relate that idea to a visual image. Ride the whole metaphor on your own (ex: How was the development of colonies in ancient American history similar to the growth of amobia?). Or encourage students to develop their metaphors (If the main body parts were animals, what would they be?) (Armstrong, 2006: 75).

4. Sketch of the idea: A review of the memoirs of many prominent people in history such as Darwin, Edison and Ford show that these people used simple drawings to develop many of their great ideas, and the whole point in these drawings is a kind of visual (visual) thinking that is consistent with the thinking of these famous people. (Nofal, 2007: 221).

Teachers should recognize the value of this type of visual thinking in helping students to define and articulate their understanding of the subject matter. The idea-drawing strategy involves asking students to draw the main point, idea, central theme, or central concept being taught. In this regard, it is necessary to reduce the focus on arrangement and realism in favor of a quick succession of drawings (sketches) that help clarify the idea , In order to prepare the students for this type of drawing, it may be helpful to play the game of winning, losing or drawing so that the students get used to the idea of making quick drawings that convey the central ideas, and then we begin to direct the students to draw the concept or idea that they want to focus on in the lesson. This strategy can be used to assess students' understanding. (Armstrong, 2006: 75).

5. Pictographs: One of the oldest traditional teaching strategies is that which requires words to be written on the board, and is less common after primary school drawing pictures on the board, even though the pictures may be very important to the comprehension of students with a spatial tendency, and accordingly, teachers who can support their teaching with drawings, diagrams, illustrations, and pictures, as well as with words, may reach a wider range of learners. This strategy then requires the practice of drawing at least in part of our lessons. For example, to create illustrative graphic symbols that depict the concepts you are learning. (Jaber, 2003: 97).

The second axis:The Cognitive Representation

When dealing with the process of cognitive representation, it is necessary to talk about the cognitive structure, as they are two sides of the same coin, as the cognitive structure represents the product of the representation process and its images that were formed by various mental processors of the information represented. Ausubel and others (Ausubel, et al, 1978) mentioned in Al-Zayyat (2004) define the cognitive structure as the comprehensive content of the individual's cumulative knowledge and its distinct organizational properties that characterize the individual's

cognitive domain (Al-Zayyat, 2004: p. 417). Gray (1983) builds his definition of the cognitive structure on the opinion of Ausubel, where he mentions that the knowledge structure of the learner consists of two aspects: content and organization, and the content includes facts, concepts, principles, ideas, names, positions, functions, processes, colors, etc. As for the organization, it is what includes basic relationships or links. And the secondary between the various facts and concepts (Al-Sayed, 2005: p. 8). Fouad Abu Hatab and Amal Sadiq (1994) mention that the essence of the Ausubel model of the cognitive structure is based on the assumption of the amount, clarity and organization of the current knowledge of the learner, this current knowledge, which consists of facts, concepts, issues, and raw perceptual data that is available to the learner at a given moment, is what Ozubel calls the cognitive structure (Abu Hatab and Sadiq, 1994: p. 319).

Scott (1979), referred to in Al-Zayyat (2004), believes that the cognitive structure includes applications resulting from the interaction between the cognitive content, including information, facts, concepts, ideas, rules, laws, issues, perceptual data, and cognitive processes that address this content (Al-Zayyat, 2004: p. 416). Some researchers in the field of psychology defined it as an understanding of the interrelationships between the important concepts of individuals (Goldsmith & et al, 1991: p88).

The cognitive construction of the individual is a cumulative structure in which the individual's information and knowledge interact with his direct and indirect experiences, which provides him with a good base for treatment methods, which supports his ability to bring about a good and effective integration of categories and patterns of knowledge related to many fields, and then his abilities to solve problems grow. This growing or cumulative knowledge leads to the creation of networks of associations that are organized, producing distinctions and specific, non-random methods, consisting of categories, relationships, systems, transfers, and knowledge inclusions that have meaning and functions, as these associations take various forms, some of which are hierarchical (hierarchical). Some are matrix

And others are arboreal, and each of them can be employed in realizing a situation or finding a solution to a problem, and the rich knowledge

structure involves self-activation that makes this knowledge alive and effective, capable of being reduced from the processing and processing operations to a minimum level, so the pressure on the information processing and processing system is reduced, so it is directed in a better way. Directly to synthesis and derivation processes to produce new solutions and ideas (Al-Zayyat, 1998: pp. 217-218).

As for Al-Sayed (2005), he believes that the cognitive structure of the individual and its characteristics are among the most important foundations upon which the processing and processing of information is based, whatever the forms of mental activity are the subject of processing.

That the cognitive structure plays a more important role than the role of cognitive processes in bringing about cognitive changes in the individual, and that the difference between outstanding performance and normal performance in the various mental activities carried out or produced by individuals is due to the difference between them in the characteristics of the cognitive structure more than it is due to the differences between them in cognitive processes (Sayed, 2005: p. 3).

Cognitive representation of information means the process of transforming different stimuli and experiences (the semantics of symbolic formulations of words, symbols and concepts) and (the semantics of formal formulations of images, shapes and drawings). To meanings, ideas, and mental perceptions that can be encoded, absorbed, and inhabited in an organized manner to become part of the cognitive structure of the individual in the long-term memory and his cognitive tools in continuous interaction with the world around him, where the information is reorganized and represented in a way in which the information becomes ready for retrieval at the time of need. Accordingly, the relationship between the permanent knowledge structure of the individual and the efficiency or effectiveness of knowledge representation is a reciprocal relationship based on influence and vulnerability, and this relationship appears through the following determinants:

The cognitive structure, with its quantitative and quantitative characteristics, reflects the content of the long-term memory on which the memory of meanings is based, which forms the basis for the efficiency

and effectiveness of transforming the semantics of symbolic and formal formulations into meaning.

The symbolic and formal formulations and their implications when transformed into meanings, ideas and mental perceptions affect once again the quantitative and qualitative characteristics of the individual's cognitive structure. That each of the cognitive structure with its quantitative and qualitative characteristics and the degree of efficiency or effectiveness of cognitive representation stand interacting behind the individual differences in the output of cognitive mental activities, processing and processing strategies, including the activities of learning, retention, storage, synthesis, generation, inference, generalization and retrieval. (Al-Zayyat, 1998: pp. 227-228).

The process of cognitive representation of information is a mental process parallel to the processes of biological assimilation, as it is represented in integrating the elements of new experiences into the system of the individual's organic knowledge structure. For example, the process of digesting food or the process of photosynthesis in plants.

As is the case in biological representation, cognitive representation in mental life includes the integration of new data with the original internal cognitive structures. This process is not a passive process of copying reality or merely linking the stimulus to the response. But it is a process carried out by the internal cognitive structures to purify the input stimuli and stimuli through activities carried out by the cognitive structures, and therefore the buildings enrich themselves. Through the processes of addition and organization, for example, the rabbit eating carrots, the rabbit does not become a carrot, but the carrot becomes part of the rabbit (Qatami, 2005: p. 259).

It is worth noting that the cognitive representation of information is a basic complex process consisting of a number of simple mental processes that together form a hierarchical series of levels, so that memorization and storage come at the base of the hierarchical structure. It means preserving the information in its raw form, and residing in the knowledge structure of the learner or his memory until it represents a part of it. At the second higher level comes linking and classification, which means linking the input information to those that exist in the learner's memory, and classifying them into categories that facilitate their retrieval.

Synthesis comes in the third level, and it means the harmonization between the information entered and the old information in the memory. As for the fourth level, derivation and generation come, which means deducing and generating new information , and new meanings and ideas from that information in memory, or that arise due to the synthesis between old and new information.

The fifth level witnesses what is known as use and employment, which means using information and employing it in an effective and productive manner for various purposes, while self-evaluation comes at the highest of these levels, and means performing classification, synthesis, or derivation operations on the information in memory or the cognitive structure in light of the errors that appear after Conducting the recruitment process for information (Mohamed, 2008: p. 13). Most theorists talked about the process of cognitive representation of information and experiences that the individual exercises towards the contents of the surrounding environment, regardless of its different sources and the diversity of its stimuli. Secondly, that it is pictorial, audio, or kinetic experiences and information, and whether it is in writing or symbolic, or in forms, charts, drawings, and the way the individual deals with it, whether in whole or in part, or in relational relationships with other information and experiences, or by reorganization and new formulation (Abdul Wahed, 59, 2012).

The most important methods that scientists talked about in representing information can be summarized in the following ways:

1- Representing the information as it was perceived (Perception-Based Knowledge-:sensations), that is, the information is represented as it was visually perceived, that is, as received from the human senses.

2- Representing information on the basis of meaning (Meaning-Based K knowledge Riper-:sensations) and the meanings of the various stimuli are represented, whether the information is visual, auditory, or otherwise. Two methods have emerged from the representation of meanings:

A- Representation of information according to Propositional Representation Networks models: It is another form of representation of meanings that takes place through storing information according to a relational network of information according to its basic concepts and defining the relationship between these concepts.

B - Representing information through schemas representation models, which is another model for representing meanings according to a hypothetical mental schema through which the meanings of information are organized in an abstract way (Al-Atoum, 2010: p. 174).

Chapter Three: Research Methodology and Procedures

This chapter deals with the procedures adopted by the researcher to achieve the objectives of the current research, and includes a description of the research community, the method of selecting the sample, the steps for building its tool, and the appropriate statistical methods for data analysis. The following is a review of these procedures:

Research methodology: The researcher used the descriptive approach due to its suitability with the nature of the research objectives, as it is defined as a form of organized scientific analysis and interpretation to describe a phenomenon or problem and develop it quantitatively by collecting data and standardized information about the phenomenon or problem, classifying it, analyzing it, and subjecting it to careful study. (Imam, 2011: 325).

Research community: The research community consisted of all students of the second intermediate grade in government day schools for the academic year 2022-2023 AD, whose number is (1053), for the purpose of identifying the level of visual thinking and their cognitive preference.

Research sample: The sample is defined as a part of the community that is withdrawn in some way so that it represents the community as the best representation. In this research, the students of the second intermediate grade in Hammurabi Intermediate School for Boys were chosen intentionally, and they numbered (150) students.

Research tool: For the purpose of collecting the necessary data to achieve the objectives of the current research, the researcher prepared a test to know the level of visual thinking and a measure of cognitive representation based on theoretical definitions of the variables and by making use of previous studies. The process of building the tools went through the following steps:

A- Visual intelligence test

1- Determining the objective of the test to measure visual intelligence among intermediate school students of science (the second intermediate) in the morning schools affiliated to the Qadisiyah Governorate Center for the academic year (2022-2023).

2- Review of the previous visual intelligence tests, many studies that included the visual intelligence test were reviewed, and through that, the researcher was able to determine the test items and rely on the multiple-choice pictorial aspect.

3- Preparing the initial formula for the visual intelligence test: The researcher formulated the test situations and its paragraphs, as the test included in its initial form (15) paragraphs (imaginary) situations for each test

4- Test Correction Instructions

Before experimenting with the test reconnaissance, the researcher prepared instructions for correcting it, and thus the test score ranges between (0) as the lowest score and (30) as the highest score for the test.

5- Validity of the test

• Face Validity

The researcher presented the test to a number of arbitrators with expertise and specialization in the field of education, psychology, teaching methods, and subject teachers (experts) to express their opinions and directives regarding the test situations and its paragraphs and estimate its validity.

• Construct Validity

The relationship of the score of each paragraph to the total score of the test will be calculated after applying the test reconnaissance.

7- Exploratory application of the test

The visual intelligence test was applied to a survey sample as follows:

7- 1 - The first survey application

The researcher applied the test on a sample of (20) students from the second grade (Al-Kawthar Intermediate School for Boys) to demonstrate

the clarity of its paragraphs and instructions, as well as for the purpose of calculating the time required for students to answer the paragraphs.

Where the test was applied on Tuesday corresponding to (6/12/2022) and the clarity of the paragraphs was confirmed and the time required to answer the test paragraphs was calculated, by means of (the average response time) it took for the first (5) students and the last (5) students to answer the test, which reached (40) minutes.

7-2 - The second survey application

After the researcher made sure of the test, its paragraphs, instructions, and the time required to complete it, the researcher decided to apply it again to a sample consisting of (100) students from the intermediate stage of science on Thursday (12/15/2022) distributed as (50) students from Algeria Intermediate School for Boys and (50) student from Al-Baha Intermediate School for Boys.

8- Determining the psychometric characteristics of the test

8-1 - The relationship of the paragraph score with the total score of the test

In order to verify the existence of a correlation between the degree of each paragraph of the test paragraphs and the total score of the test, the researcher used the point-Biserial correlation coefficient equation, as the results showed that the correlation coefficients are all statistically significant at the level of significance (0.05), as the calculated value ranged between (0.05). 50.58- 74.70), and thus all items are considered acceptable, and the test has internal consistency (correlation coefficients).

8-2 - coefficient of difficulty of the test items

Difficulty coefficients can be calculated for each of the test items by calculating the number of correct responses for each item and applying the difficulty equation for each item of the test. The difficulty coefficients for the test items ranged between (0.215-0.556), and thus all the test items are acceptable and have an appropriate difficulty coefficient.

8- 3 - The ability to distinguish test items

For the purpose of calculating the discrimination coefficients for the test items, the researcher used the special equation for that, and the results

showed that the value of the discrimination coefficient for the test items ranged between (30.58-62.35), so all test items are good, as the tests are considered good if their stability coefficient reaches (0.67) or more. (Al Nabhan, 2004: 240).

8- 4- The stability of the test

• Hash method midterm

The stability coefficient was extracted between the two halves of the test (odd and even items) using the Pearson correlation coefficient and it was (0.80). The correction was done using the Spearman-Brown equation, so the stability coefficient after correction reached (0.84), which is a high stability coefficient.

• **Cronbakh Alpha method** (internal consistency of the test): The researcher found that the value of the alpha coefficient calculated for the visual intelligence test is equal to (0.80), which indicates the stability of the test.

9- The final version of the visual intelligence test

It consists of (15) simulated paragraphs of a situation, and the test measures visual intelligence, a degree of sensitivity to color, line, shape, nature, field, and the relationships that exist between these elements: In addition, the researcher has prepared a key to correct the test.

B- Cognitive Preference Scale:

It was carried out according to the following procedures:

1- Determining the purpose of the scale

The main objective for which the scale was designed was to measure the cognitive preference of intermediate school students of science (the second intermediate) in the morning schools affiliated to the center of Al-Qadisiyah Governorate for the academic year (2022-2023).

Examination of previous studies determines the aim of the current research to know the effect of teaching using the strategy of scientific stations on achievement and visual-spatial intelligence in physics among first-grade intermediate students.

As a teaching strategy interested in presenting the scientific material in multiple and interesting ways to increase achievement in physics and visual-spatial intelligence among first-grade intermediate students, and to achieve the objectives of the research, the following two zero hypotheses were formulated:

1- There is no statistically significant difference at the level of significance (0.05) between the average differences of the scores of the students of the experimental group who study the prescribed subject according to the scientific situations strategy and the students of the control group who study the same subject according to the usual method of achievement.

2- There is no statistically significant difference at the level of significance (0.05) between the mean differences of the scores of the students of the experimental group who study according to the strategy of scientific stations and the students of the control group who study according to the usual method in visual-spatial intelligence.

The research was limited to the students of the first intermediate grade in the day secondary schools of the General Directorate of Diwaniyah Education for the academic year (2011-2012).

1- The researcher used the experimental design of two equal groups with a pre-posttest, the experimental group and the control group, and according to this design, the study sample was intentionally chosen in (Ibn Sina Intermediate School). The sample of the study was (60) students who were randomly divided into two groups, one of which was chosen randomly (by lot) to represent the experimental group, and it included (30) students who studied the prescribed subject using the scientific stations strategy, and the other was chosen to represent the control group, which included (30) students who studied the same subject using the usual method.

The results showed, using the Statistical Bag for Social Sciences (SPSS-10) and (Microsoft excel) the following:

1- The students of the experimental group who studied according to the strategy of scientific stations outperformed the students of the control group who studied according to the usual method in the achievement test.

2- The students of the experimental group who studied according to the scientific situation's strategy excelled over the students of the control group who studied according to the usual method in visual-spatial intelligence. In light of the results of the research, the researcher recommended the need to use the strategy of scientific stations in teaching science, especially physics, and to include this strategy in the programs for preparing teachers and teachers, as well as directing the attention of those in charge of developing curricula, especially physics curricula, to the importance of topics, activities and experiments that develop visual-spatial intelligence.

2- Determine the areas of the cognitive preference scale, as the scale consists of six areas, namely: - Retention property: the mechanism for storing and retaining information. The property of meaning: realizing the meaning of information and its verbal and idiomatic connotations. Linking: The ability to link information with each other of different types to increase its awareness or to produce new cognitive representational formulas. Fourth - the characteristic of derivation: the ability to give a new perception of information Fifth - Synthesis: The ability to integrate and organize information in an intellectual framework according to degrees of similarity or difference, or part and all. Sixth - The multi-format feature of cognitive representation: the ability to translate the knowledge output in a variety of cognitive performance forms.

3- Formulation the items of the scale: The scale, in its initial form, consists of (18) items with three alternatives (always, sometimes, rarely) within six domains, each domain has three items.

4- Instructions for answering the scale: The researcher prepared a set of instructions to explain to the study sample students how to answer the scale items

5- Instructions for correcting the paragraphs of the scale: The researcher prepared a set of instructions that specify the method of correcting the paragraphs

6. The validity of the scale

• Face Validity

After preparing the instructions and paragraphs of the cognitive preference scale of (18) paragraphs in their initial form, the researcher

presented them to a group of arbitrators and experts specialized in educational psychology teaching methods and a number of science teachers who study this subject in the intermediate and preparatory stages of the classrooms and a number of specialized supervisors.

• Construct Validity

The relationship of the score of each paragraph to the total score of the test will be calculated after applying the scale reconnaissance.

7- Exploratory application of the cognitive preference scale

7- 1 - The first survey application

The researcher applied the scale on a sample of (20) students from Al-Kawthar Intermediate School, and the average response to the test items was (39) minutes, by calculating the total time taken by the first five answers, which is (36) minutes, and the last five answers, which were (42) minutes. divided by (2).

7-2 - The second survey application

After the researcher made sure of the scale, its paragraphs, instructions, and the time required to complete it, the researcher applied it again to a sample consisting of (100) students from the intermediate stage of science on Thursday (12/15/2022) distributed as (50) students from Algeria Intermediate School for Boys and (50) A student from Al-Baha Intermediate School for Boys.

8- Determining the psychometric characteristics of the scale

8-1 - The relationship of the paragraph score with the total score of the test

To achieve this procedure, correlation coefficients were calculated using the Pearson method to find the relationship of the paragraph score with the total score of the scale by subjecting all the statistical analysis sample forms to this procedure, and all the paragraphs had a statistically significant correlation coefficient. As its values ranged between (0.217-0.498) at the level of significance (0.05), and thus all items are acceptable and the scale has internal consistency.

8-2- The Power of discrimination for the paragraphs of the scale

The calculated t-value for some paragraphs of the scale ranged between (0.22-0.51), and accordingly, when comparing the calculated t-value for each paragraph with the tabular t-value of (1.96) at the level of significance (0.05). And with a degree of freedom (106). Through this step, it became clear that all items of the scale are statistically significant, which means that all items have the ability to distinguish between the members of the survey sample.

-The degree of each paragraph in the field to which it belongs:

It turned out that all the items of the scale, which numbered (18) items, belong to their fields, because the values of the Pearson correlation coefficient were all statistically significant, because they are greater than the tabular value of the correlation coefficient of (0.13). at the level of significance (0.05) and with a degree of freedom (198).

-The relationship of the domain to the total score of the cognitive preference scale:

After extracting the relationship of the paragraph to the total degree and the relationship of the paragraph to the field to which it belongs, the researcher resorted to a complementary procedure for the process of internal consistency of the (cognitive preference) scale, which is to extract the consistency of the field as a whole with the total degree of the scale based on the responses of the second survey sample of (150) students. It goes the same way as the whole scale.

Constancy

The researcher relied on Cronbach's alpha equation for the internal consistency of the scale and the method of re-testing, and it was calculated for the statistical analysis sample, and the stability coefficient was reached in this way (0.77).

The final application of the scale: The scale has been applied in its final form. After extracting the psychometric characteristics and scientific bases of the (cognitive preference) scale, the researcher obtained the final form of the scale if it consists of (18) paragraphs distributed over six journals, each field has (3) paragraphs of correction keys from (1-3) with a fixed response time estimated at (10-20) minutes.

Statistical means: The Statistical Package for Social Science (SPSS) was adopted in the statistical treatments.

Chapter Four: Presentation and Interpretation of the Results

The first objective: To know the extent to which intermediate school students possess visual intelligence in science

Table (1) The results of the t-test for one sample to test the significance of the difference between the arithmetic mean and the hypothetical average of the scores of the sample on the critical thinking test

variable	sample	AM	standard deviation	Hypothetical average	The t value for one sample		indication 0.05
					calculated	Tabular	
Visual intelligence	150	30,27	6,53	22,5	27,970	1.98	function

It is clear from the above table that the arithmetic mean of the sample exceeds the hypothetical mean. When testing the significance of this difference, it was found to be statistically significant at the level (0.05), and this confirms that the research sample has visual intelligence.

The second objective: To know the extent to which intermediate school students have cognitive preference in science

The arithmetic mean and standard deviation of the scores of all sample members were calculated, and after using the t-test equation for one sample to find out the significance of the differences between the arithmetic mean and the hypothetical mean, it was found that there was a statistically significant difference between the mean scores of the sample

and the hypothetical mean, meaning that the research sample individuals have a cognitive preference.

Table (2) t-test results for one sample to test the significance of the difference between the arithmetic mean and the hypothetical mean of the respondents' scores on the cognitive preference scale

variable	sample	SMA	standard deviation	Hypothetical average	The t value for one sample		indication 0.05
					calculated	Tabular	
Visual intelligence	150	31,28	6,21	21	41,53	1.98	function

The third objective: to identify the relationship between visual intelligence and cognitive preference in science among intermediate school students.

In identifying the strength and type of correlation between visual intelligence and cognitive preference, Pearson's equation for simple linear correlation was adopted, and the value was (0.15). In order to verify the t-value of the significance of the correlation coefficient, the calculated t-value which amounted to (2.14) was compared with the tabular value which amounted to (1.98). Thus, it is clear that there is a statistical significance of the correlation coefficient at the level of significance (0.05), as in the following table.

Table (3) The correlation between visual intelligence and cognitive preference

sample	correlation coefficient	The t value of the significance of the correlation coefficient		Significance at the level (0.05)
		calculated	Tabular	
150	0,15	2,14	1.98	function

This result shows the existence of a direct correlation between the two variables, that the independent and dependent variable have a positive direct correlation, the higher the visual intelligence of the sample, the higher the cognitive preference for them. If many educators indicate that it is not better for the learner to identify the correct and wrong information, but it is better to determine how the learner prefers to deal with this information mentally. This requires visual thinking, just as the acceptance and preference of scientific information requires reflection on its content and visual review.

Conclusion: Based on the results, the following conclusions were reached:

1. Intermediate school students have visual intelligence.

2. Intermediate school students have a cognitive preference.

3. There is a direct positive relationship between visual intelligence and cognitive preference among intermediate school students.

Recommendations

The researcher recommends the following:

1. The need to enable students to develop and invest their ability in visual thinking.

2. Holding educational and counseling seminars for students in order to improve their level of cognitive preference.

Suggestions: The researcher suggests the following:

1- Conducting similar studies to measure the level of visual thinking in other societies and stages (primary, university).

2- Conducting similar studies on visual thinking and its relationship to some variables such as social acceptance and academic achievement.

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