The Effect of the Similarities Strategy in Developing Complex Thinking among Fourth-Grade Students in Science in Biology

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Abstract

The present paper aims to identify the effect of the strategy of the similarities in the development of composite thinking among the fourth grade students in the field of biology. The partial experimental design of the experimental and control groups was selected. The number of students in the study sample was 56 students. They were divided into two experimental groups and 28 students in each group. The students studied the experimental group according to the strategy of similarities, while the students of the control group studied according to the usual method.

Students of the experimental and control groups were rewarded with variables: (intelligence and age in months, previous student achievement in biology in the intermediate, composite thinking test as well as parental achievement). A test of composite thinking was prepared (30). A vertex test was carried out. The validity of the test was verified by presenting it to experts and arbitrators in the field of pedagogy and teaching method). Nine a daily teaching plan for the experimental group and the same for the control group. The teaching plans of the experimental group were organized according to the strategic steps of the similarities and the teaching plans of the control group according to the usual method. The experiment was applied in the first semester of the academic year (2019-2020).

Data were statistically treated using t-test for independent and interrelated samples. The results showed that the experimental group was better than the peers in the control group, which was studied at the usual way in the composite thinking test. The paper reached several recommendations, suggestions.

Introduction

First: the paper problem: Problem of the

Today, the world is witnessing progress in all fields, as nations are distinguished by their knowledge, science and educated human wealth capable of reviving themselves by themselves through their abilities and keeping pace with the developments of the times, where the educational process is one of the most important of these areas that enjoy great progress and interest, and from here the subject Biology as an important scientific subject for the individual and society must be promoted to change the prevailing routine in it and make it a life substance, because it enters the life of the individual in all his fields, where hardly a field in life is devoid of biology, so we must pay more attention to it for progress and advancement.

Biology, by its nature, presents living organisms in all their details and their relationship with each other and with the environment in which they live. and humanity, and then the final criterion for the function of any study subject is its feasibility and the extent to which it fulfills its functions.

From this point of view, biology must transform it from a subject that depends on memorization and memorization into a state of thinking so that the matter does not lead to a waste of the value of this substance and a distortion of its functions (Al-Laqani, 1999, p. 140).

Based on the foregoing, we are required to keep pace with the tremendous cognitive development and scientific and technological progress, and this requires unleashing more potentials of students in an effort to confront and stand up to the

shortcomings and weaknesses in the methods of teaching biology, and it became necessary for the biology teacher to choose the most appropriate methods and modern teaching strategies that would develop Thinking skills because modern education calls for that and as a simple attempt to develop teaching methods, including the methods of teaching biology, a modern teaching strategy applied in our schools was chosen, which is the similarity strategy as an attempt to raise the level of students in the development of complex thinking. He put the following question: (Does the similarity strategy have an impact on developing complex thinking?).

Second: Paper of the Importance

Biology is an important material in knowing and understanding information, knowledge, facts and methods that help to understand the living organism with its various components and its work with its surrounding environment. (Mahmoud et al., 2002, p. 10)

At the present time, biology is no longer a study subject aimed at collecting information and facts and stuffing the minds of students with them without knowing the way to how to benefit from them. This subject made it lose its importance by focusing the students on the information and facts in order to pass the end of the year exam. Therefore, it should focus in teaching it on providing students with ways of thinking and providing them with skills and concepts that may help them solve the problems they encounter and access information from various sources on their own. (Salman, 1987, p. 10)

Despite the importance of biology and the role it can play in achieving the goals of education by preparing students and providing them with a number of scientific paper skills that help them deal with society and the changes that have occurred in it, it is still viewed from a narrow perspective. This is due to the teaching methods and methods that are used in teaching biology, those theoretical and traditional methods that

depend on memorization on the part of the teacher and memorization of information on the part of the students. (Edward, 1962, p. 263), and here the role of the teacher in the teaching process emerges, and it is one of the main factors The teacher has a very important role in this process, as he embodies the democratic ideal and is considered a model for students to follow, and his personality is the determining factor in the success or failure of the teaching program. (Skinner, 1959: p 464).

The successful teacher always strives for the optimal choice of the appropriate method. He is interested in acquiring basic concepts, skill in thinking, a great deal of knowledge, personal compatibility, controlling his emotions, and giving students the desired directions. (Jaber, 1977: pp. 47-48).

The successful method helps the teacher to reach the goal in the least time and the easiest effort, while arousing the students' interest and motivating them to work positively and actively participate in the lesson without getting tired of the lesson or causing them to wander. (Sarhan, 1986: p. 12).

The similarity strategy is based on facilitating the understanding of the uncommon abstract concepts "similar" by focusing on the analogy with the "similar" real world in which the individual lives and knowing the common features "similarities" and features outside the topic "differences" by stimulating the students and providing their motivation towards learning The analogy or the topic, and that pictures and diagrams communicate information, transcend language barriers, and convey the message to readers of all languages without the need for translation, in application of the old saying "a picture is better expression than a thousand words". This, in turn, develops in the learner the power of observation, reflection, and in-depth consideration of all the similes presented to him, to the extent that he is able to distinguish between the subject of the analogy and the suspect by identifying the

differences between them. This response is an effective tool in building knowledge that the learner performs on A base of concepts that he learns and that are available in his cognitive structure, as well as that it represents an effective tool in modifying perceptions (Zaytoun, 2002, p. 255).

The strategy indicates the importance of the teacher's role as a leader and mentor, and the first thing he does is to explain the similar in a way that does not make the learners feel that they are compelled. (Kandil, 2006, p. 95).

The similarity strategy is based on analogous thinking, in which similar traits are transferred from one situation to another through a schematic process drawn to support the similar elements between the target and similar concept, which is seen from two sides, namely, structural processes and cognitive processes. (Abdul-Moati, 2002, p. 200).

Thinking is one of the most prominent abilities that transcend human beings from other creatures, and it is one of the important needs without which an individual's life cannot be straightened and he does not abandon it except in the absence of the mind. New ideas that help in solving the problems they face. (Tafesh, 2004, p. 3) Because thought and thinking are of paramount importance and consideration, God Almighty has directed His speeches to minds as stated in the Noble Qur'an in His saying: Hashr, 21). In fact, thinking is of great importance in a person's life, as it helps him to solve many problems and avoid dangers by anticipating danger as a result of the inferences and analysis he makes. itself or to treat it in a realistic, scientific way. (Esawy, 1999, p. 175).

There is an urgent need to raise a generation that relies on brain skills in an integrated manner through the development of students' minds and the development of their thinking patterns. We also need to provide an educational system that constitutes thinking at its highest levels and levels, especially complex thinking, which consists of the three types: critical thinking, creative thinking, and reflective thinking. Thinking that both (creative and critical) thinking are essential to effective thinking.

(Anis 1989) believes that innovative thinking refers to the ability to create and contribute new and original ideas, while critical thinking appears in the evaluation of ideas and their application at the theoretical and practical levels. The critical thinker must be creative. Good thinking that combines critical thinking and innovative thinking and is supported by (Nouras and Anis). High-ranking thinking is thinking that includes innovative and critical thinking and goes further, as he sees that there is no purely innovative thinking without critical thinking and there is no pure critical thinking without innovative thinking. Al-Atoum and others, 2007, p. 107)

The availability of basic thinking skills leads to an increase in the effectiveness of using the mind to its maximum capacity in order to reach the so-called maximal thinking. (Mahmoud, 2009, p. 234) Also, these skills are required and essential to employ other dimensions of thinking if they are used in the service of meta-thinking processes. cognitive.

Creative thinking is one of the most important patterns of thinking that emphasized modern and contemporary education, and it is an atypical mental activity that departs from the usual, familiar way of thinking, leading to outcomes characterized by innovation and novelty. It includes the skills of fluency, flexibility, originality and excellence, and includes mental processes that lead the mind to innovation (Atiya, 2015, p. 128).

And reflective thinking, which is one of the types of complex thinking, is a basic requirement in the life of the individual, because many situations require solving problems in our daily lives, and it is the most complex and important form of human behavior. Teaching students this type of thinking helps them to make sound decisions about situations and events. (Abu Ghazal, 2007, p. 21).

The paper chose the middle school stage as it is an important stage and has a kind of privacy represented in the occurrence of fundamental changes on the student, these changes are organic and psychological at the same time, as the student at this stage is in most need of activities that help him emotional and social independence and unload his energies in a scientifically acceptable manner. Al-Atoum, 2008, pp. 102-103).

It is hoped that the current paper and its results in the field of teaching scientific subjects and those in charge of it and papers in it will benefit by providing feedback to those responsible for the program for preparing teachers of science subjects, allowing to reconsider the importance of these two skills and the possibility of activating them better in these programs. This paper could be the beginning of studies And other paper related to the two mentioned skills, especially in a field that lacks such paper and studies, which is the field of scientific subjects.

The importance of the current paper is reflected in:

1. The importance of the similarities strategy, which is among the important strategies that can be implemented in the teaching of biology.

2. Developing complex thinking among students and considering it a primary goal in teaching scientific subjects, especially biology.

3. The consistency of the current paper with modern educational trends that allow the student the opportunity to carry out mental operations that contribute to his growth and thinking, and make it an effective activity, and make teaching a cooperative process in which the teacher and student participate.

Third: Paper Purpose

The current paper aims to identify the effect of the similarities strategy in the development of complex thinking among students of the fourth scientific grade in biology.

Fourth: Hypotheses of Paper

1- There are no statistically significant differences between the average scores of the experimental group students who study biology according to the similarities strategy and the average scores of the religious control group students who study biology according to the traditional method in the dimensional complex thinking test.

2- There is no statistically significant difference at the level (0.05) between the average scores of the experimental group students who study biology according to the similarities strategy in the test of pre and post composite thinking.

Fifth: Limitation of the Paper
The current search is limited to:

1- Students of the fourth scientific class for the year 2019-2020) in the secondary and middle schools of the day affiliated to the General Directorate of Education / Salah al-Din Governorate - Department of Home Education.

2- Chapters (first, second, third, fourth) of the biology book to be taught to students of the fourth scientific grade for the academic year (2019-2020)

3- The first semester of the academic year (2019-2020)

Sixth: Defining terminology
The paper will define the terms in their theoretical and procedural aspects:

First, the strategy
  She was known by:-
• (Taha, 2010)
 The teaching strategy expresses the long-term teaching plan for multiple situations, and is used to teach a course or unit of study, and it is more general and comprehensive than the method or the approach, as it includes the most teaching method to achieve long-term goals that require time, follow-up and integration of experiences." (Taha, 2010, p. 40)

• (Hamadena and Obeidat, 2012)
"A set of steps and procedures carried out by the teacher in an organized, coherent and sequential

manner so that they are comprehensive, flexible and consistent with the requirements of the lesson." (Hamadena and Obeidat, 2012, pg 4).

The paper defines it procedurally:

The set of procedures and methods that the paper follows with the students of the fourth scientific grade when teaching the chapters (first, second, third and fourth) of the biology book.

Second, the similarity strategy

She was known by:-

• (Olive, 2002)

An effective tool that facilitates the process of building knowledge for the individual on the basis of the concepts he knows and available in his previous structure. (Zaytoun, 2002, p. 255).

• (Al-Ahmad, 2003)

A teaching strategy that helps examine aspects of a problem to arrive at a solution to make the stranger familiar. (Al-Ahmad, 2003, p. 65).

The paper defines it procedurally:

A set of procedures carried out by the paper with the intention of comparing and simulating the concepts mentioned in the Biology book with the intention of facilitating their learning for the students of the experimental group.

Third: Development, defined by:

• (Madbouly, 2002): "It is the development and progress towards the best in the educational level, and keeping pace with the changes and innovations taking place in educational situations." (Madbouly, 2002, p. 83)

The paper defines it theoretically: it is an intentional process in which attention is focused on an existing thing, and this interest leads to development and progress towards the better and better.

The paper defines it procedurally: it is the remarkable progress and development in the degrees of creative thinking skills for the first and second experimental groups compared to the degrees of creative thinking skills in the control group.

Fourth: Thinking was defined by:

• (Al-Atoum et al., 2007).

It is a cognitive activity that works to give the environmental stimuli meaning and significance through the cognitive structure to help the individual adapt and adapt to the environmental conditions. (Al-Atoum et al., 2007, p. 19).

Complex thinking was defined by:

• (Atiya, 2015) is the thinking that is suitable for facing complex or complex problems, and it is a type of divergent thinking that requires high skills and abilities. (Atiya, 2015 p. 118).

• (Al-Atoum et al. 2007) as hasty thinking, which includes critical thinking skills and creative thinking. The paper adopted in his paper the theoretical definition of Al-Atoum and others (2007).

procedural definition for complex thinking.

It is the total score obtained by the respondent from the sample members through his answer to the complex thinking test prepared by the paper.

Second: A theoretical introduction to the paper variables

Similarity strategy:

The similarity strategy is based on the constructivist philosophy, and is based on sensory examples and similarities from the environment surrounding the student, thus facilitating the process of learning and correct understanding. Building the knowledge that the individual makes on the basis of the concepts he knows and available in his previous knowledge structure (Zaytoon, 2000, p. 329).

In many cases, when an individual encounters something new that he has not been familiar with before, he automatically resorts to a search process in his knowledge store for something familiar that he has previously tested in order to examine the possibility of transferring knowledge from what is familiar to what is new, and the question that is often asked in such cases is What does it look like? His success in dealing with the new situation depends on his skill in comparison, and the comparison process requires identifying the similarities and differences between two or

more things by examining the relationships between them, searching for points of agreement and points of disagreement and seeing what is present in one of them and missing in the other (Jarwan, 1999, p. 175).

Objectives achieved by the similarity strategy:
Similarities seek to achieve a number of goals, including the following:

1- Activating the right side of the brain by noticing the similarities between things, and finding the relationships between them.

2- This strategy works to modify the misconceptions in the brain structure of the learners, which makes their creative imaginative abilities at a better level.

3- In this strategy, visual perceptions are used to embody abstract concepts, which increases the ability of the right side of the brain to deal with visual intellectual issues (Afaneh and Youssef, 2009, pp. 219-220).

4- It develops in students some intelligences such as visual/spatial intelligence, when using similes, it also develops in learners linguistic intelligence and logical-mathematical intelligence.

5- It helps to change the wrong understanding of students, because it works to bring abstract scientific concepts closer.

6- It helps the teacher to teach the subjects of the nature of science, because scientists also use similes in their understanding of scientific phenomena.

7- Develop the mental processes of the students, because the learner seeks to employ something known and familiar or its characteristics to something that has a kind of difficulty and abstraction.

8- It makes the learning process endearing to the students because the similes connect the students with their lives (Ambo Saidi and Suleiman, 2009, pp. 568-569).

Methods of using the similarity strategy in teaching:
There are three ways to present the analogy for teaching using the analogy strategy:

1- A type that depends on the teacher only, and it is called (transversal - explanatory teaching).

2- A type that depends on the teacher's help as a mentor, and it is called (guided teaching).

3- A type that depends on the students themselves (Afaneh and Youssef, 2009, p. 217).

• Types of analogy:

1- Verbal similes:

It is intended to use words, such as likening women to the moon on the night of the full moon and likening them to a deer, likening their eyes to the eyes of an oryx, likening women to bottles, likening time to a sword, and life situations to stations (Ambo Saidi and Suleiman, 2009, p. 568).

2- Pictorial similes:

It is intended to use visual representations and representations that belong to the area of the suspect, in a way that enables the teacher or the author of the book to shed light on the characteristics that we focus on in the suspect.

3- Imaginary similes:

It means that the teacher or the author of the book presents a hypothetical or imaginary scheme that will increase the students' pleasure and suspense to study the target topic or concept.

4- Storytelling:

The teacher uses one familiar field to explain several concepts from another unfamiliar field.

Factors on which learning by analogy depends:
First: Factors related to the characteristics of the student:

1- Familiarity with the analogy:

Familiarity in the analogy is one of the important factors. The more the suspect is known and familiar with the students, the better the learning process will be. Corn topic.

2- Tribal information on the subject:

This factor is the use of similes in learning situations, which achieves good results, and when

it is used in a topic that the students are not familiar with, and providing students with similes when matching in the background knowledge may distract their attention from the presentation of the learning material, which adds an unnecessary burden on the learning materials.

3- Visual Imagination:

Here, the imaginative ability plays an important role in learning by analogy.

Second: Factors related to the education process:

1- The complexity of the analogy:

The complexity of the analogy is one of the factors that are directly related to the learning process. For example, when the electron is compared to water, the similarities are: (cohesion in size and composition, moving in random directions, moving in large areas, moving in the direction of the forces acting, differing in their quantity according to the conductors, Its conduction numbers remain fixed, its numbers are free to move depending on the strength of the conductors that connect it and external forces, and it can transfer the kinetic energy to other bodies.

2- The degree of perceptibility of the analogy:

As for the degree of sensibility of the similes, the similes differ in relation to the degree of their sensibility for both the subject and the suspect, as in the case of comparing the eye to a camera, or abstract similes such as images of the camera with images of the eye, or verbal, or a mixture of the three together.

3- The number of similarities included in the same analogy:

In this factor there is not a single evidence that using a single simile is better than using a single simile Several similes work (Zaytoun, 2000, pp. 332-334).

• Teaching steps using the similarity strategy:

The steps of teaching using the similarity strategy are as follows:

1- Choosing the suspect from the potential experience available to the target learner.

2- Determining the place that will be placed in the suspect in the textbook, or that the teacher will use in his teaching. The similes can be placed in one of three places or places in the textbook, (a) at the beginning of the lesson as an advanced organizer, (b) within the text in a presentation merged with it, (c) at the end as a summary.

3- Remind the reader of the characteristics of the suspect, which are related to the target topic.

4- Make a detailed comparison between the suspect and the target subject.

5- Directing the learner's attention to how the target subject differs from the suspect (Atifa and Aida, 2011, pp. 462-464).

6- Directing the learners to try to reach for themselves certain conclusions from the comparison between the suspect and the suspect.

Reflective thinking:

He was known by:

(Atiya / 2015): (It is intentional thinking directed towards specific goals and is used when thinking addresses a problem that confronts the individual or poses a challenge to him, and it is a purposeful mental activity. (Atiya, 2015, p. 122)

As for (griffith & frieden .2000), they defined it as (the continuous study of ideas and assumptions available in a person's mind so that they contribute to strengthening and strengthening his opinions and ideas) (griffith & frieden p.82.2000).

• Critical thinking :

It was defined by Gerlid (2003. p.1): Thinking aims to develop and make its outputs meaningful and important to the individual, as he sees it.

As for critical thinking according to Piaget, it is contrasted with abstract thinking, and it includes three components: formulating generalizations with caution, considering possibilities and alternatives, and suspending judgment on the situation until sufficient evidence is available (Meyer. 1991).

• Creative thinking: It is a mental process and activity that occurs throughout a person's life

Hoing (2001) defined it: It is divergent thinking that includes breaking down old ideas, reconnecting them, expanding knowledge, and generating new ideas based on mental interaction

and increasing the conceptual distance between the individual and his experiences. (hoing.2001.p.34)

It was defined by Anderson and King (Anderson & King. 1993): It is a mental process based on generating and modifying ideas based on previous experiences and information, which leads the individual to new structures and structures (Anderson & King. 1993.p.34).

Complex thinking:

Complex thinking is among the important topics in the field of cognitive psychology, and the visions around it have varied due to its multiplicity of facets and dimensions to the point of overlapping and ambiguity, and this is what we see and what is reflected in the complexity of the human mind and its operations.

Thinking in general is like other abstract concepts such as intelligence, which is difficult for a person to measure directly. For this reason, papers and specialists have been forced to describe it to various types of names and descriptions for the purpose of distinguishing between its types. Many specialists have unanimously agreed that thinking is a continuous line, one of its ends representing a simple pattern of thinking, while the other end represents an advanced pattern, as is the case in concrete/abstract thinking, convergent/divergent thinking, hasty/reflective thinking, and critical/creative thinking (Al-Atoum et al., 2007). , 17)

Papers and specialists in the field of thinking have emphasized that there are two levels of thinking patterns according to the degree of complexity of each of its different patterns, namely:

1- Lower basic thinking skills, which represent basic mental processes such as knowledge (understanding and remembering), observation, comparison, classification, sensory and practical thinking. It also includes lower cognitive levels such as knowledge, comprehension, and application. In order to secure the duty, knowledge and proficiency in it before moving to the levels of complex thinking.

2- Hiqher.complex thinking skills, which include the use of complex mental processes, and include reflective, creative, critical and metacognitive thinking skills, etc., which enable us to interpret, analyze and process information to answer a question or solve an intractable problem if I did not use the basic minimum thinking skills, make our judgments, give opinions, and use multiple criteria and criteria to reach the result.

Third Paper Methodology and Procedures

This chapter deals with paper procedures, methodology, experimental design and tools, as well as the statistical methods used to process its data.

First: the experimental design of the paper:

Choosing the appropriate experimental design for the paper is of great importance because it ensures the proper structure of the paper and access to reliable results in finding the problems of the paper and verifying its hypotheses. Accordingly, the paper used in his study the design of equivalent groups, which is a design with two groups, one is control and the other is experimental.

Shape (1): The experimental design used in the research

post test	independent variable	pretest	the group
complex thinking	Similarity strategy	complex thinking	Experimental
	normal method		control

Second: The paper community and its sample:

a - paper community:

The paper community consisted of all students of the fourth scientific grade in the district of Al-Dour distributed among four middle schools for the academic year (2019-2020).

b - paper sample

Divisions (A) and (B) were selected. For the fourth scientific grade, their number reached (59) students as an initial sample for the paper, and in a simple random way, Division (A) became the control group that will be studied according to the usual method, and Division (B) represents the experimental group that will be studied according

to the strategy of similarities, then the students who failed were excluded. 3) Students, in order to avoid the impact of previous experience that may affect the results of the paper. Thus, the paper sample consisted of (56) students who were divided into two groups.

Third: Equality of the two paper groups:

Before starting the actual teaching, the paper was keen on the statistical equality of the students of the two paper groups in some variables that are believed to affect the safety of the experiment and the accuracy of its results. The calculated value was less than the tabular value, and table (1) shows this:

T value		control (30)		(30) Experimental		The group / Variables
calculated	tabular	standard deviation	SMA	standard deviation	SMA	
*0.197	2.00 Indication level (54) function 0.05	11.84	29.86	8.49	29.33	intelligence
*0.36		5.500	38.800	5.97	39.33	complex thinking
*0.02		12.757	72.16	12.629	72.23	Achievement in neighborhoods
*0.64		6.41	182.13	5.42	183.10	Chronological age

In order to adjust the educational level variable for the parents of the student, the square (Ka2) was used as a statistical method to treat the data for this variable for the two paper groups. Table (2) illustrates this.

Fourth: Controlling the extraneous variables:

The internal variables of accidental events, maturity, measurement tool, sample selection and non-interruption were controlled by the sample members and the educational environment.

Duration of the experiment: The duration of the experiment was equal for the students of the experimental and control groups. The actual application of the experiment to two paper groups began on Monday, 7/10/2019 AD, and ended on Thursday, December 26, 2019. The experiment

took a full semester, with three lessons per week. for each group.

Fifth: Requirements for the application of the experiment:

1- Determining the study subject: The subject that will be studied during the course of the experiment was determined by the topics prescribed in biology for the fourth scientific grade for the academic year (2019-2020) in the first academic course.

The experiment included the first four chapters, which are one of the topics of the Biology book for the fourth scientific grade. The experimental and control groups were taught equally. The paper adhered to the prescribed topics without adding or decreasing, since this book is systematic, issued

by the Ministry of Education in the Republic of Iraq.

2- Distribution of teaching lessons: the teaching shares were distributed by allocating three lectures per week to each group; This is according to the distribution of the shares decided by the school administration.

3- Preparing the teaching plans: the teaching plans were developed according to the similarities strategy, and the teaching plans for the same chapters were also made in the usual way. The number of plans reached (18) teaching plans, with (9) plans for the experimental group and (9) plans for the control group, then models Of the two types of teaching plans, a group of experts specialized in the field of teaching methods, educational and psychological sciences, to ensure their suitability and in the light of their opinions and suggestions, some plans were modified in light of the observations made by the experts, and the plans became ready in their final form.

Sixth: The search tool:
Complex thinking test:

In the absence of a ready-made tool that measures the goal of the paper, it needs a tool to measure the complex thinking of the two paper groups at the beginning and end of the experiment in order to identify the impact of the similarities strategy in developing complex thinking. The paper reviewed a number of literature and studies to benefit from them in preparing his paper tool, which dealt with measuring the Complex thinking in general from subjects other than biology, and among those paperes and studies (Al-Zubaidi study 2015) in high-ranking thinking and a study (Al-Sharida Bishara 2010) in complex thinking, looking at the way in which the paragraphs were formulated and how to reach the correct answers and in different situations Then the paper formulated the test paragraphs in the form of introductions (positions), followed by alternatives that may be two or three, according to what the field or skill requires. The validity and reliability of the test,

and the distinctiveness of its paragraphs, were confirmed through:

First, the apparent sincerity:

The validity of the test is one of the most important means in judging the validity of the test by ensuring the extent to which the test performs the function for which it was used. Specialization in educational, psychological and biology sciences, and in light of the agreement of 80% of the arbitrators, a number of paragraphs were amended because they were poorly worded and did not fit the intellectual and age level of the students (the paper sample), where the test was retained, thus achieving the test's apparent honesty.

Formulating test instructions:

The test instructions give the examinee an idea of the type of test, its length (number of paragraphs) and the time allotted for it, so the instructions should be given in an easy, clear, simplified and short language as possible. It is important to use the instructions in the experiment and in the final image of the test, for all that the paper prepared the instructions for the test as follows:

Answer instructions:

The paper prepared the instructions for answering the paragraphs of the complex thinking test to be easy and clear. The instructions included a number of test paragraphs (illustrative example) and asked the students to read the instructions carefully before starting to answer them as they saw fit and correct, as well as asking them to answer all the test paragraphs and not leave any paragraph of the test. Test items without an answer.

Test correction method:

Paper mode m A caliber to correct the responses on the test items, as follows:

1- One point for the correct answer for each paragraph of the test.

2- 0 for the incorrect answer or which includes two answers.

Prospective application of the test:

The exploratory application of the test aims to:

1- Explanation of the clarity of the test questions and instructions.

2- Determine the time taken to answer the questions.

3- Finding the discriminatory power for each of the test items.

4- Calculate the stability of the test.

Therefore, the paper chose an exploratory sample from Al-Watan Preparatory School for Boys, consisting of 36 students of the fourth scientific grade. The test was applied to them on 10/6/2019, during which the time for the first student to complete the answer was recorded, which was 30 minutes, and the last student was 40 minutes, after calculating the average time It was found that the time taken to complete the answer is 35 minutes.

Survey experience:

In order to verify the clarity and validity of the test paragraphs and the time taken to answer it, and to analyze the paragraphs statistically and to verify its stability, the paper applied the test to an exploratory sample similar to the paper sample consisting of (100) students from the fourth scientific students on Tuesday (1/10/2019). The paper reached the time of answering the test items by calculating the average time of the students, by recording the time during calculating the average time of the students, by recording the time on each student's answer sheet in order to extract the answer time. The average response time for the complex thinking paragraphs was (45) minutes, after calculating the response time

Second: The discriminatory power of the paragraphs of the complex thinking test:

In order to identify the validity of the test and the clarity of paragraphs regarding students, the answers were corrected after dividing them into

two groups (50% high group), which includes 50 students and (50% lower group), which includes 50 students, and the discriminatory power was calculated for each of the paragraphs The test was done by using the T-test for two independent samples, at a significance level of (5%) and a degree of freedom (34), and after conducting statistical transactions, (5 items) were excluded because they are not statistically significant. Thus, the complex thinking test in its final form consists of 30 items.

Third: The stability of the complex thinking test:

The complex thinking test was confirmed using the Couder-Richardson equation (20) to calculate the stability, and this equation can be applied in the test in which the degree of answering the paragraph is either true, it takes one degree, or false, it takes zero, and the reliability coefficient reached (82%), which is a high stability coefficient.

The final formula for the complex thinking test:

After the paper verified the validity and reliability of the test, the test in its final form consisted of 30 items, and the paper was given one point for each item upon correction, and thus the final score was (30 degrees).

Fourth: Results

This chapter includes the presentation and interpretation of the paper results according to the two hypotheses of the paper and comparing them with the results of previous studies. It also includes conclusions, recommendations and suggestions as follows:

First: View the results:

1- The results of the first hypothesis, which read:

There is no statistically significant difference between the mean scores of the students in the experimental group who study using the

similarities strategy and the students in the control group who study in the usual way of complex thinking.

To verify this hypothesis, the paper applied the t-test for two future samples (T-Test) and after correcting the students' answers in the two groups (experimental and control) on the complex thinking test. And the degree of freedom (54), which is greater than the T-table value of (2.00), and accordingly, statistically significant differences appeared between the experimental and control groups in favor of the experimental group, as shown in Table (3).

Table (3)
T-test for two independent samples of the experimental and control group
In the post-test of the complex thinking test

Indication level	T Value	standard deviation	SMA	The group
function	2.78	5.82	43.51	Trial after me
		4.46	39.65	post officer

2- The results of the T-Hypothesis, which read:

There is no statistically significant difference between the mean scores of the students in the experimental group in the pre and post composite thinking test.

To verify this hypothesis, the paper applied the T-test to assign two independents (T.Test) and after correcting the students' answers to the two tests, pre and post tests of complex thinking. It is greater than the tabular t-value of (2.00), and accordingly, there were statistically significant differences between the experimental and control group and in favor of the experimental group, as shown in Table (4):

Table (4)
T-test of two correlated samples of the experimental group In the pre and post test of the complex thinking test

Indication level	T value	skew difference	average differences	standard deviation	SMA	The group
function	4.86	4.74	4.2	5.97	39.33	trial before me
				5.84	43.53	Trial after me

Second: Interpretation of the results:

It is clear from the results obtained regarding the two hypotheses shown in Tables (3) and (4) that there are statistically significant differences between the experimental and control groups in complex thinking and in favor of the experimental group in the dimensional complex thinking test. There is also a statistically significant difference between the pre- and post-test in the complex thinking test for the students of the experimental group and in favor of dimensional thinking, and

this indicates the effect of the similarities strategy compared to the usual method in developing complex thinking among the students of the experimental group. The paper attributes the superiority of the experimental group over the control group in complex thinking. and its development. The results can be interpreted as follows:-

1- The strategy of similarities arouse the interest of students, who have motives and motivation in educational activities as well On their benefit from

the various obstacles in their environment, the new knowledge, which enabled them to learn, so that their learning became meaningful.

2- The similarity strategy enabled the learner to confront the learner through real tasks, and thus their learning became meaningful and not just memorizing the information by heart.

3- The similarity strategy aroused the attention of the students, which enabled them to benefit from the information they received and make it remain an impact in their minds.

4- Complex thinking was not an inevitable product of the general growth process, but rather requires plans, programs and curricula that allow students to carry out direct practices that lead towards this goal. Which can be achieved and grow through the purposeful use of the similarity strategy.

5- It seems that the use of the similarities strategy has eliminated the monotonous and usual situation in the classroom, which is called the state of brilliance, group thinking, and group questions that are related to the contents of the lesson.

Third: Conclusions

1- The similarity strategy is highly effective in developing complex thinking among middle school students.

2- The possibility of applying the similarity strategy with middle school students in various subjects.

3- The possibility of using the similarity strategy in our current schools in light of the possibilities available in schools.

Fourth: recommendations.

In light of the paper results, the paper recommended the following:

1- The introduction of teaching strategies, including the strategy of similarities, in the vocabulary of teaching methods taught in the College of Education.

2- The necessity of adopting similarity strategies in teaching biology because of its potential in developing complex thinking.

3- Expanding interest in the subject of complex thinking and training biology teachers, whether they are in the preparatory stage or in the teaching courses held for them, on how to develop thinking in general and complex thinking in particular.

Fifthly, the suggestions

In light of the paper results, the paper put forward the following suggestions:

1- Studying the effect of the similarities strategy on other types of thinking, such as scientific thinking and systemic thinking.

2- Studying the effect of modern teaching strategies such as (Scamper's strategy and Costa and Calic's strategy) on developing complex thinking.

3- The procedures of studies similar to this study and on other stages of study and on other study subjects.

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