

# THE EFFECTIVENESS OF BACK-TO-BACK STRATEGY IN IMAGINATIVE THINKING AMONG FIFTH GRADE PRIMARY FEMALE STUDENTS IN SCIENCE SUBJECT

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**Abstract:** *The current research aims to identify the effectiveness of the back-to-back strategy in imaginative thinking among fifth grade students in science subject.*

*The researcher relied on the experimental design with partial control and represents the research community of the fifth-Grade primary school pupils in the girls' primary schools of the General Directorate of Education of Diyala Governorate, Balad Rose, the academic year 2022/2023, and Harran Primary School for Girls was chosen as the research sample. It included 78 pupils distributed in two divisions and in a random draw method. The 38 pupils represented the experimental group that will study science according to the back-to-back strategy, while the 40 pupils represented the control group that teaches science according to the usual method. The researcher conducted an equivalence between the pupils of the two research groups before starting the experiment in a number of variables, namely (the age of the pupils calculated by months, IQ test, Imaginative thinking test)*

*The scientific material to be taught, which included the first three units of the science textbook dedicated to teaching the fifth-grade primary school year (2022/2023), and the researcher formulated behavioral goals for the subjects she will study, which are (209) behavioral goals according to Bloom's classification of the cognitive field and its three levels (remember, understand, apply) and prepared daily plans to teach the two research groups. The researcher prepared the research tool represented in the Imaginative thinking test in the science material, as it consists of (15) test items of the multiple choice type, and its validity, reliability and psychometric characteristics were verified. After the end of the experiment, the researcher applied the Imaginative thinking test to the two research groups. After analyzing the results statistically using the T-test for two independent samples, the research results resulted in the strategy of the back and back having a positive effect on the Imaginative thinking of the students of the fifth grade in the science material, since it is more effective than the method of habituality and based on its dependence, the result was reached from the presentation of the recommendations and proposals in the fourth chapter, which will be presented in the fourth chapter.*

**Keywords** / Back-to-Back Strategy, Imaginative thinking.

## RESEARCH PROBLEM:

Despite the progress in the field teachings methods of science and what is called for by recent trends in education, the prevailing belief in the effectiveness of education depends on indoctrination, that is, the negative role of the learner, which indicates a significant decline in the teaching methods and methods followed by teachers in the subject of science, so that this subject has turned into just information given to learners without having the possibility of understanding the structure of that subject, which makes the student a passive recipient of information, which leads to extinguishing the creative flame of the learner represented by the ability to think, which is one of the important goals in teaching science. The learners have a way of thinking that is better than acquiring them as well as knowledge, which is in constant change and development. Imaginative thinking is one of the types of thinking and the imagination of thinking skills. The imagined mind meditates and deep thinking and creates conditions that are consistent with



knowledge, which helps to solve problems, organize ideas and master knowledge. Imaginative thinking skills are mental skills that work to develop the creativity of the learner.

The researcher confirmed that the problem is still ongoing and exists by asking a number of questions in the open survey questionnaire Appendix (3) for a sample of science teachers for the daytime government primary schools for girls affiliated with the Directorate of Education of Diyala | Rose Country, as they were randomly selected " who have not less than (5) years of experience in the field of teaching science for the fifth grade of primary. The answers were as follows :

- 1-(90%) of female teachers use traditional methods and techniques in teaching with different educational situations and cognitive levels of learners and do not follow modern teaching methods,
- 2- (97%) of the teachers' answers showed that they did not know the back-to-back strategy.
- 3-(100%) of the answers confirmed their lack of knowledge of imaginative thinking skills and strategies for their development

Hence, the researcher's research problem crystallized through the use of modern and appropriate teaching methods such as the back-to-back strategy, which may contribute to raising the level of imaginative thinking of learners. Therefore, the research problem was determined by the following question:

(What is the effectiveness of the back-to-back strategy in imaginative thinking among fifth grade students in science subject ?)

### RESEARCH SIGNIFICANCE.

The world is witnessing a scientific competition and a technological struggle, as the strength of nations is measured today as much as the scientific and technological progress they are making, and from this perspective science and its technologies have become necessary and necessary for the life of every individual living in his era , and this in turn made education affected by the ways of using technology by teachers and learners themselves to face the rapid scientific development, We live in a changing world in all aspects of life, especially in terms of information technology, and therefore these developments require a review of the teaching and learning process in order to ensure that each learner learns the skills required and needed in the twenty-first century. (Khalil ,2013 :28 )

Education is a purposeful process, in the sense that it is a deliberate process to make desired changes in it, which determines and indicates the educational objectives. It includes the changes to be made in the learners and what the learners can know and learn .(Al-Huwaidi , 2010: 75)

Educational curricula are the means by which education can prepare learners and develop their cognitive, motor and emotional aspects to face life with all its changes and diversity while qualifying learners to manage their problems. Therefore, it has become the duty of those in charge of education to upgrade the curricula as a means of education to reach its goal and objectives ( Attia, 2008: 15)

Since the primary stage is one of the important stages, as it is the basis for the later stages, the stronger the foundation, the more solid the educational system is to meet the requirements of the times, so it is necessary to pay attention to that stage by making learners know a lot about their daily lives and what is happening in their environment, and work to develop their tendencies towards knowledge, experience and discovery. (Al-Azzawi, 2003: 4)

Educators and specialists in science subject curricula and teaching methods emphasize that the teaching of science is no longer just a transfer of scientific knowledge to the learner as is prevalent in traditional teachings methods , but has become a process concerned with the transfer of previous knowledge to the learner and the construction of new knowledge, acquisition, understanding, retention and use in different life situations (Zaytoun,2007: 20) , so teachers should use various teaching methods, then the teaching process will remain dependent on the teacher and his personality and it must be emphasized that the teaching process is not well-structured, nor is it proceeding according to specific conditions and standards because this is mainly related to the personality of the teacher and his characteristics and characteristics . (Salama et al., 2009: 49)



The teacher's extensive knowledge of the teaching methods and their various strategies, and his ability to use them will undoubtedly help him to know the appropriate teaching conditions for application, so that the teaching process becomes interesting and enjoyable for students, suitable for their abilities, and also relevant to their daily life, needs, tendencies, desires and future aspirations (Mari and Mohammed, 2005 : 25) , The process of transferring modern ideas to the minds of learners requires teachers to go beyond the traditional teachings methods and adhere to modern methods that suit the learner we want, A learner who trusts in his knowledge and his role in future life by providing him with advanced experiences according to more contemporary methods beyond our reality, in which teachers still rely on traditional teaching methods based on memorization and memorization in teaching science , and since the understanding of concepts is one of the pillars of real knowledge and its key, so it is necessary that the education process is concerned with achieving understanding, providing the learner with the necessary thinking skills to discover and innovate knowledge and achieve integration between different experiences on the basis of the unity of knowledge, and deepening his ability to think scientifically, so it is imperative for science teachers in general and life science teachers in particular to work on building students' thinking through the use of new methods that contribute to the understanding of concepts and the development of their thinking skills. (Sheikho, 11: 2019\_12)

This is what was stated in the recommendations of scientific conferences that call for the development of the curriculum and rely on modern teaching methods and benefit from educational technology and techniques, including the 21st Scientific Conference held in Baghdad in 2005, which stressed the need to develop curricula and the introduction of modern technologies in teaching to keep pace with the rapid scientific development in the process of teaching and learning (Al-Mustansiriya University, 2005: 11) , as well as the Seventh International Conference of Humanities at Wasit University for the year (2014), which indicated in its recommendations, the emphasis on the use of teaching methods that make the learner the focus of the educational process, and the use of modern technologies that keep pace with technological and scientific development and move away from traditional teachings methods that focus on indoctrination. (College of Education Conference, 2014: 125)

For the purpose of improving the methods and methods used in teaching in general , and teaching the subject of science in particular, it was necessary to adopt strategies and teaching methods commensurate with the modern trend that focuses on the learner and make it the focus of the educational process. One of these teaching strategies is the back-to-back strategy: which is a teaching method that engages learners in doing things that force them to think about what they are learning. All active learning strategies aim to help learners make links between course materials, and thus transform them from abstract language and cognitive avi-car stored in their data bank, and can be remembered and retrieved when needed (Ramadan, 2016 :41) .

The back-to-back strategy contributes to revealing individual differences between learners and working to reduce them in learning. (Al-Saffar, 42:20).

To think is important in the educational community, attention has escalated to become one of the main objectives of the curricula and improve the level of students' learning. Moreover, modern educational theories have focused on it, such as its focus on teaching mental simulation in reading and writing. These things all require focusing on thinking skills (Ryan, 2012: 102) , which in turn enables man to deal and control different situations and is through acquiring concepts and experiences, understanding the nature of things, interpreting them, solving problems, planning and making decisions. It also includes processing information using symbols, perceptions, language and concepts with the aim of reaching certain outputs (Zaghloul, 2003: 273)

Imaginative thinking is one of the types of thinking and is an essential and effective element in the system of thinking and mental activity, so attention must be paid to its development among students because of its great benefit in the student learning the subjects. Imaginative thinking is the ability of the individual to photograph, and build multiple mental imaginations where the learner thinks, and dreams of things that have not happened before, and is characterized by



thinking intuition or love of guessing , and thus has the ability to reach his thinking beyond reality (2008,136 beghetto)

Imaginative thinking works to : get the learner to think about phenomena, search for the interpretation of relationships between things , develop the ability to imagine with attention, focus, get rid of anxiety , bring abstract concepts closer, reveal the abilities of the learner , and give the learner real pleasure (Emposaidi and Suleiman, 24:2009).

Imaginative thinking was used in the educational process by imagining in the development of various methods to stimulate the mind, as a study (Smith, 2010) confirmed that Imaginative thinking has an important impact on the educational process in terms of the learner's retrieval of his information in the form of images that are easy to use in the situations he needs.

Learners have a study (John, 2011) that confirmed that imaginative thinking methods led to advanced results in schools to raise the level of their thinking and solve problems, which is one of the skills of regular and liberal thinking and that we should pay attention to the mental system and employ it in the service of man for the thing that supports him in his theoretical and scientific life. It helps to develop the creative abilities and curiosity of the learner and link between previous and new learning and dealing with reality meaningfully, retrieving, collecting and rebuilding the learned information and turning abstract ideas into sensory images that are easy to deal with, which leads to the generation of ideas and scientific explanations in the future (Abdul Aziz, 138:2012)

The researcher concludes from the above the importance of the current research with the following points: -

1-The current research is the first experimental study (to the best of the researcher's knowledge) to identify the effectiveness of the back-to-back strategy among fifth grade primary school female students and their imaginative thinking.

2- The current study provides specialists and researchers with a test of imaginative thinking.

3)Provide teachers with a strategy that they can apply to primary school female students that may contribute to raising the level of imaginative thinking.

4-A source that enriches libraries with a changing field of research, which may benefit researchers and graduate students.

### **Third : Research Objective**

The current research aims to identify (the effectiveness of the back-to-back strategy in the Imaginative thinking of the fifth grade primary students in science subject )

### **Fourth : Research Hypothesis**

There is no statistically significant difference between the average scores of the students of the experimental group who will study according to the back-to-back strategy and the average scores of the students of the control group who will study according to the usual method in the Imaginative thinking test.

Fifth: Research Limits:

1-The objective limits/the first three units (classification and diversity, human body and health,article ) of the Science Book for the fifth grade primary, fifth edition, the year 2021

2- Time limits /first semester 2022-2023 AD

3-Human borders/fifth grade primary schoolgirls in the daytime primary schools of the General Directorate of Diyala Education.

4- Spatial boundaries /primary schools for girls belonging to the Directorate of Education of Baqubah /Baladroz District/Mandali sub-district.

### **Sixth : Definition of terms**

**First: - Effectiveness : Defined by :**

1. (Al-Masoudi et al., 2015)as "the ability to accomplish goals or inputs to achieve the desired results and reach them to the maximum extent possible" (Al-Masoudi et al., 2015: 95).
2. (Al-Saadi, 2020) as "the ability or efficiency of the organization to achieve the impact of a specific action according to certain criteria to bring about change and reach the desired goal" (Al-Saadi, 2020 : 23).



The researcher adopts the definition ( Al-Masoudi et al., 2015) a theoretical definition of being the closest to the research goal.

Procedurally, the researcher defines it as:

The amount of change expected from the use of the "back-to-back" strategy in acquiring scientific concepts for female students in the fifth grade in the subject of science and Imaginative thinking .

**Second: - Back-to-back strategy: Defined by each of :**

1. (Al-Shammari, 2011) as : "An activity based on interaction between students, so that it encourages students to work with each other, develops their communication, observation and clarification skills, and motivates them to have active listening skills" (Al-Shammari, 2011: 104).
2. (Abu Al-Hajj and Reconciliation, 2016) as "an activity that encourages students to work with each other, develops their communication, observation and clarification skills, and stimulates active listening skills" (Abu Al-Hajj and Reconciliation, 2016: 100)

The researcher adopts the definition of ( Al-Shammari, 2011)a theoretical definition of being the closest to the steps of the research.

**Procedurally, the researcher defines it as :**

A teaching strategy that relies on the interaction between the audiovisual learning styles of the students of the experimental group, based on the use of images, where each pair of students sit opposite so that they meet from the back and a picture is displayed to one of the two students, who in turn talk about it in all its apparent and internal meanings, while the other student listens to her and draws what she hears from the details of the image.

**Third: - Imaginative thinking :defined by :**

1. (Al-Tayeb, 2006) that: "An activity carried out by an individual as a result of one of the mental abilities that collect mental images obtained by the senses , then synthesize these images and reshape them in an innovative way to help obtain a new form of them that differs from reality." (Al-Tayeb , 181:2006).
2. (Zeitoun, 2007)that: "It is the ability to think images, which is based on the formation of relationships organized in the form of images and depends on the skill of retrieval and his skill of remembering and mental perception" (Zeitoun, 2007: 85).

The researcher adopts the definition (Zaitoun, 2007) a theoretical definition of being the closest to the steps of her research .

The researcher defines it procedurally as :

Is the ability to think about the image and things in the organization and formation of relationships measured by the degree to which the student gets through her answer to the Imaginative thinking test prepared by the researcher and applies the end of the research experience.

### **Active Learning**

#### **• Foundations and principles of active learning:**

Active learning is based on a number of principles that must be observed in order for learning to become active learning in the intended sense.

- 1- It is a comprehensive system of learning : it guides the processes of teaching and learning, gives the opportunity for practice and pedagogical learning applications, and leads to the desired learning outcomes with a high degree of proficiency and quality.
- 2- Focuses on setting goals and determining their importance , diversity , and comprehensiveness of the three aspects of cognitive, emotional, and skill .
- 3- Availability of a strategy : Teaching that includes various methods and teachings methods .
- 4- Within its scope, roles and concepts (teacher-student role, curricula , methods) change from traditional learning styles.
- 5- Through which he exercises various activities and experiences that are part of his strategies.
- 6- It is a learning that emphasizes the three types of learning ( individual , group, and self ).
- 7- A type of learning that adopts the centrality of learning in the sense that the student makes it the focus of learning.
- 8- It takes into account individual differences among learners.



9- It helps the learner to discover, improve and develop his/her potential.  
Develops positive behaviors in learners such as innovation and self-reliance.  
( Emposaidi and Huda 2016: 65 )

- **Active Learning Objectives:**

Active learning aims to achieve many goals, including :

1- Diversity in educational activities that suit the level of the learner and their needs and abilities and provide them with the skills, trends and knowledge planned to achieve the desired educational goals.

2- Providing learners with real life experiences and situations related to reality, which makes education more effective, as well as encouraging learners to dialogue and discussion, and contribute to setting goals and striving to achieve them.

3- Enabling learners to acquire dialogue and discussion skills for communication and social cooperation, and to carry out joint actions for the harmony of learners in the educational environment (Khairy 2018 :31).

4- Encouraging learners to acquire desirable knowledge, information and trends, enabling them to solve problems, make decisions and take responsibility, and encouraging them to possess higher thinking skills such as synthesis, analysis, evaluation and solving important issues.

Developing modern learning strategies that help the teacher to use various educational activities that suit the needs of learners by identifying the latest educational methods and using them in a realistic educational situation. (Saadeh et al., 2011: 40).

- ❖ **Active Learning Strategies:**

Active learning strategies include a wide range of activities that are combined by one important element, which is that the learner engages in some work and at the same time think about what they are doing. Educators have identified many active learning strategies, most notably a number of writers and specialists in this field. The researcher has been briefed on a set of literature that dealt with active learning strategies. The multiplicity of active learning strategies is attributed to the activity and effort made by the learner during his learning, through active participation with his colleagues in order to accomplish educational activities with the least time and effort under the supervision of the teacher, who is a facilitator and observer of the learning process. Strategies are used depending on the level of learners, the nature of the study material and the subject. There is no optimal strategy in teaching, but there are more appropriate methods for some subjects and some subjects. He has classified them (Abu Al-Hajj and Reconciliation , 2017) into (40) strategies that fit with the nature and characteristics of the learner , of which we mention the following:

1. Concept Map Strategy
2. Guided Imagination Strategy.
3. The hot seat strategy.
4. Mental Visualization Strategy.
5. Concept Network Strategy.
6. Find the Fib strategy.
7. Strategy of tiered activities.
8. Back-to-back strategy.

We will touch on a strategy of active learning strategies, namely the strategy of backpacking the focus of the current research topic.

- ❖ **Back-to-back strategy**

The back-to-back strategy aims to develop the skills of working with the group, and it also helps to develop the thinking and problem-solving skills of students. (Imbo Saidi and Al-Hosaniya, 2016: 67)

- **Back-to-Back Strategy Steps**

- 1) The teacher divides the learner into peers and the seats are opposite so that the back is at the back and they hear each other when the activity begins, and no learner should turn to his colleague at any time.
- 2) The first learner has a visual stimulus (image), anthropomorphic, real element....) The second learner has a pen and paper.



- 3) The first learner describes the picture to the second learner who draws the description of his colleague accurately in terms of shape, size, details the events in the picture or the main processes without focusing on the technical quality of the drawing.
- 4) The second learner asks any question according to his need, also the teacher may set the time so that there is a specific time.
- 5) The learner compares their drawings after the time is up.
- 6) The learner may switch roles.
- 7) The teacher assesses the business and focuses on the processes and skills that have occurred such as asking questions, brainstorming, and communication.

(Hajj and Reconciliation, 100:2016)

#### ❖ The Concept of Imaginative thinking

The ability of man to adapt and participate effectively results from an active imagination. The condition for developing man's mental and intellectual potential to reach higher levels depends on his imagination if he unleashes it, which makes him see events and things around him differently than they are. The need to employ the imagination of individuals through academic foundations, whether it is by reading literature, or it is about imagining and absorbing historical events, or it is about producing and appreciating various arts because man uses his imagination to retrieve old images and exploit them mentally (2017:191 , Diyanni).

Beveridge believes that the process of thinking is organized as in the steps of "John Dewey", which are (feeling and feeling the problem and all ideas and information related to the problem, then imposing hypotheses and discussing hypotheses, and then reaching results) without being effective and suddenly the individual may reach innovative solutions, and in order for the individual to reach original and innovative ideas, he must unleash his imaginations flexibly and freely without hindrance (Al-Maghazi, 2015: 47).

Beghatto (2008 Beghatto, ) pointed out that Imaginative thinking represents the ability of the individual to build and visualize multiple mental fantasies, and his thinking is characterized by guessing and intuition to reach his thinking beyond knowledge, as he pointed out (Al-Tayeb , 2006) that the concept of Imaginative thinking extends its significance to include the imagination itself, its effectiveness and its production at the same time, so one part of it is linked to an internal process related to the soul, which is imagination, and the other side is linked to an external factor, which is reality, and the imagined thing is the point of contact between these two aspects (Al-Tayeb, 182:2006).

Wiri ( Salman, 2010) It is the ability of an individual to perform semi-sensory or perceptual mental processes that he is aware of by his self-perception, through which previous sensory experiences are reconstructed, formed and stored in memory in order to produce a mental image that may resemble or differ from their sensory or perceptual counterparts ( Salman , 13:2010)

#### • Imaginative thinking Patterns

1.Retrospective imaginative thinking: This style is limited to the restoration of previous mental images without adding any modifications to them, as it depends on the previous knowledge and experiences of learners and the extent of their diversity and scrutiny in a way that allows them to retrieve them from memory.

2.Followive imaginative thinking: This style is limited to following previous perceptions based on the synthesis of mental images, and this style is restricted without innovation, renewal or creativity.

3.Creative thinking: In this style, learners from previous perceptions create new combinations based on the synthesis of mental images and the production of new images of past experiences, such as the formation of new and unfamiliar images and patterns.

4. Predictive thinking: This type of thinking is related to anticipating future events, especially those related to the achievement of a specific goal, steps, or imagining a process or movement that can help achieve an individual's goal or solve a problem. (Kamel Waied, 2019: 36)

#### ❖ Imaginative thinking Skills



Thinking skills are generally defined as specific processes that humans intentionally employ to process information, including classification and interpretation. It is characterized by skill, discrimination and creativity and has an active role in the effectiveness of thinking (Mujahid and Abdul Wahab 2021: 19).

The categories of imaginative thinking skills were numerous ( Mahmoud, 2015). And(Kamel and Eid, 2019) and(Abdo, 2020) classified Imaginative thinking skills as follows:

- A) The skill of retrieving mental images: Retrieving information, knowledge and experiences that have been stored in memory in advance is divided into two sub-skills: coding and recall, which are among their behavioral indicators:
  - Recall information and audible data with attention to detail.
  - Recall images and previous experiences related to what is audible and describe them.
  - Bringing up mental images related to unknown people, events or places.
  - Arrange events and ideas in audible light according to certain criteria.
  - Photographing objects by drawing or word spoken or written.
  - Create mental representations or mental images of previously conceived objects.
- B) The skill of mental transformations: Reframing mental images of new forms and linking them to the reality of daily life and conducting ( deletion, addition, division, grouping, rotation, displacement, and reflection) on mental representations of objects to modify them. Behavioral indicators include:
  - Modify unfamiliar images and ideas to make them familiar.
  - Adopting words and examples from daily life in expressing thoughts and feelings.
  - Support words, whether they are verbal or written in artistic and graphic images in an integrated manner.
- C- The skill of reconstructing and creative employment: Producing new and unrealistic meanings by reconstructing mental images from their behavioral indicators:
  - Propose realistic reasons for a problem, phenomenon, or event.
  - Creating unfamiliar solutions to an actual problem.
  - Understand the texts and make appropriate headings that reflect their content.
  - Creating text, graphics and images that are contrary to reality, expressing different meanings.

Ibrahim (2016) has added the employability skill as a fourth skill to the previous imaginative thinking skills and is intended to: employ the individual mental images formed through the previous skill in new situations and solve the problems he faces .

However, Nashwah and Ryan (2021) adopted the following imaginative thinking skills:

Mental Imaging: Formation of new mental images of previously learned objects and events based on the individual's previous experiences and knowledge.

B- Mental experience: Providing future scientific explanations after combining ideas and past experiences with real-time life situations.

Forming and expanding patterns :Reconstructing the ideas and concepts acquired by the individual and transforming them from their abstract image into a sensory image that is easy to deal with.

From the above, the imaginative thinking skills used in the current research can be summarized as follows :

1.Mental image retrieval: A mental activity based on retrieving information and mental images stored by the learner in previous educational situations and then expressing them and employing them in new situations.

2.Mental Transformations: Making adjustments to the mental representation of mental images stored in the students' memory through deletion addition grouping rotation displacement reflection).

3.Reconstructing mental images: Reconstructing mental image elements to produce new, unrealistic meanings and images.

#### ❖ Characteristics of Imaginative thinking

- 1) Imaginative thinking is characterized by flexibility and freedom to form new ideas, which is a nature that distinguishes it from traditional thinking that depends on language.



- 2) It is also characterized by the richness and formability of the mental image, as mental images are inherently rich in form, color and movement.
- 3) It is characterized by spatial intuition as the spatial nature of images makes them freely manageable across space and time and transform them into verifiable forms in the form of drawings, cognitive components and information compositions.
- 4) Through which different skills are practiced such as reasoning, deduction and mental transformations ( Abdul Hamid,289:2009)

## Theme 2 : Previous Studies

To the best of her knowledge, the researcher did not find any Arab or local study that deals with the back-to-back strategy in the subject of science. Therefore, this research is the first local research that deals with the back-to-back strategy in the subject of science.

The researcher was limited to presenting previous studies according to the dependent variable, which is Imaginative thinking , as follows :

❖ Table (1) Previous Studies on Imaginative thinking

| No | Researcher's name<br>Year and Country | Research Objectives  | Sample<br>Finding | approach<br>Finding   | Research Tools  | Statistica Means   | Results Findings   |
|----|---------------------------------------|--|-------------------|-----------------------|---|--|--|
| 1  | Bani Youn<br>2017<br>Jordan           | Investigating the impact of teaching with mental maps in developing Imaginative thinking skills and changing alternative concepts in chemistry among ninth grade students                      | 46<br>Students    | Experimental Approach | Skills test<br>Imaginative thinking<br>Concept testing<br>Alternative Chemistry | Quiz<br>test retest<br>Keoder Richardson equation<br>Kuder - 20  | The experimental group outperformed the control group in testing Imaginative thinking skill and test alternative concepts in Chemistry |
| 2  | El Gouraa<br>2020<br>Iraq             | Identifying the effectiveness of training program based on the Trevinger model developing the Imaginative thinking of middle first grade students according to the levels of mental motivation | 96<br>Students    | Approach Demo         | Imaginative thinking Scale<br>Mental Motivation Scale                           | Biserial correlation<br>Bicerial t-Test<br>Pearson correlation coefficient<br>Cronbach's alpha equation<br>Cohen's equation<br>Chevette test<br>analysis of variance<br>Triple vaccine | The experimental group outperformed the control group in the Imaginative thinking scale the Mental Motivation Scale                    |

## Research Methodology and Procedures

This chapter includes a presentation of the research methodology and procedures in terms of the research methodology followed and the appropriate experimental design of the research, the identification of the research community, the selection of its sample, equivalence and the preparation of teaching plans, the preparation of its tools and related honesty and reliability , and

their requirements, and the application of experience and statistical means used in the processing of data as follows: -

**First : Research Methodology :**

The researcher followed the experimental approach to achieve the two objectives of the research. The experimental approach is one of the most accurate and efficient methods of scientific research. According to this approach, it arrives at what will be under controlled conditions, through which specific factors are controlled in the situation, a factor or factors are released to indicate the extent of their impact on a variable and reach results that are calculated accurately.

**Second : Experimental Design:**

The researcher used experimental design with partial control for two independent groups, one of which is an experimental group whose students are subject to the change of the back by back strategy, and the other is a control group whose students are subject to the usual method of teaching science as shown in FIG.

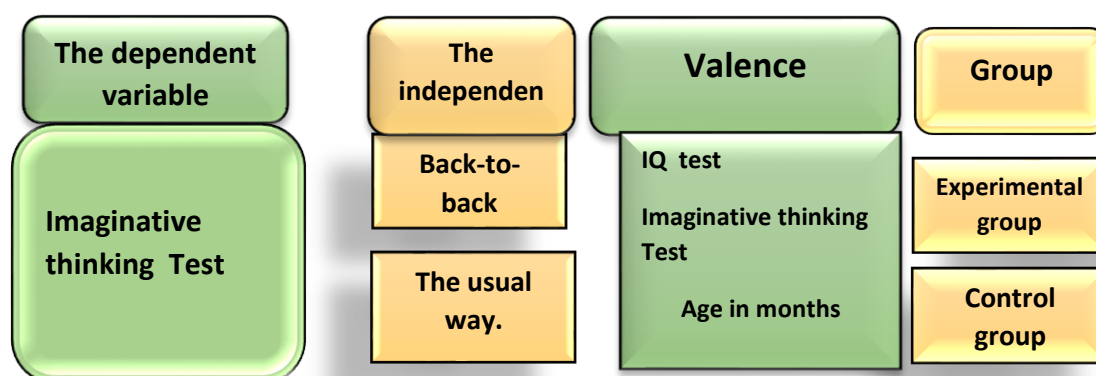


Figure (1) Experimental design of research

**Third : Research community:**

The current research community consisting of all 5 th grade primary girls' pupils in girls' primary schools affiliated to the Directorate General of Diyala Education/Baladroz District has been identified.

**Fourth : Research Sample:**

The researcher chose Harran Elementary School for Girls as an intentional sample.

**Fifth : Equivalence of the two research groups:**

The researcher made equivalence between the two research groups in some of the variables that may affect the course of the experiment, although the students of the research sample from a very similar social and economic environment, and they study in one school and of the same sex and these variables are :

1. The age of the schoolgirls is calculated in months :

The researcher conducted a statistical equivalence in the chronological age calculated in months for the pupils of the two research groups on Thursday (20/10/2022 ), as the date of birth of the pupils was obtained from the school records and the chronological age was calculated in months from the date of birth to the date of (12/10/2022).

2. IQ test

Atest consists of (36) items and each item has six alternatives, one of which is correct and the other alternatives are wrong. The answer is corrected by giving a score (one) for the correct answer, and a score (zero) for the wrong or abandoned answer without an answer.

3. Imaginative thinking Test

The researcher prepared the Imaginative thinking test and after exposure to the arbitrators and extracting the psychometric properties of it, the researcher applied the test in its final form to the experimental and control research groups, as the test consists of (15) items .

**Sixth : Control of extraneous (non-experimental) variables:**



1. The selection of sample members: One of the factors that affect the results of research is the way in which the research sample is selected, so the researcher tried to avoid this variable in the research results by conducting statistical equivalence between the two groups in the research variable.

2. Accidents: Some results are exposed to natural or abnormal accidents during the experiment that cause a delay in the course of the experiment, and have an impact on the dependent variable next to the variable that will decrease, and the research experiment was not exposed to any accident that hinders its progress, so this factor was avoided.

3. Experimental extinction: The members of the experiment sample are not exposed to abandonment or interruption, except for some individual cases of absence, which is a normal and equal condition in the two research groups.

4. Maturity-related processes:

This variable had little effect in the experiment because the students of the two groups were exposed to the same period, which is (10) weeks, as the actual teaching began on Tuesday (18/10/2022) and ended on Sunday (15/1/2023). Maturity, if it happens, happens to the students of the two groups together.

5. Measurement tool: The difference of measurement tools can affect the scores obtained by the experimental personnel, and the researcher has adjusted this variable based on the same measurement tool on the two research groups, which is the concept acquisition test, and thus the researcher maintained the adjustment process for the tools used in the experiment.

6. Experimental procedures: The researcher tried to identify some experimental procedures that could affect the course of the experiment, as follows:

- ❖ Teacher: The researcher herself studied the two research groups (experimental and control).
- ❖ **Research confidentiality:** The researcher was keen on the confidentiality of the research in agreement with the Department of the study and the teacher of the subject not to tell the students the nature of the research and its goal.

Distribution of classes: The researcher adopted the weekly schedule applied in the study without change, as the researcher studied eight classes per week, by four classes for each group.

- ❖ **B School building:** The experiment remained in one study, and in two rows adjacent to and similar in terms of the square, the number of windows and lighting, ventilation and the number, type and size of school seats.
- ❖ **Subject:** The study material covered by the experiment was the only one for the two research groups, which are the first six chapters of the Science Book. I did not decide to teach it to the students of the fifth grade of primary school for the academic year (2022/2023).
- ❖ **The duration of the experiment:** The duration of the experiment was a unit and equal for the students of the two research groups, as it began on Tuesday (18/10/2022) and ended on Sunday (15/1/2023).

#### **Seventh : Research Supplies :**

Before applying the experiment, the researcher prepared a number of basic requirements for the experiment, which are as follows:

##### **1. Identification of the scientific material:**

The researcher identified the scientific material that will be taught to the pupils of the two research groups during the duration of the experiment. The scientific material included the first six chapters of the science book for the fifth grade of primary and approved for teaching for the academic year (2022/2023), I 5, for the year (2021 AD) by its author : (Ministry of Education Committee).

##### **2. Formulating behavioral objectives**

209 behavioral goals were formulated based on the content of the material to be studied in the experiment, distributed among the three levels in Bloom's classification: (knowledge, understanding, application).

##### **4. Preparing teaching plans:**



The researcher prepared (24) teaching plans for each of the two research groups according to the topics adopted for teaching during the duration of the experiment.

#### **Eighth : Research Tool:**

In order to know the extent to which the research goal was achieved and its hypothesis required the preparation of a tool to measure the dependent variable is:

##### ❖ Imaginative thinking Test.

The following is an explanation of the procedures followed in building the tool:

##### ❖ **Determine the goal of the Imaginative thinking test:**It aims to measure the Imaginative thinking skills of the fifth grade primary school female students.

##### ❖ **items formulation in their initial form:**

In light of the definition of Imaginative thinking and after reviewing the researcher on the literature and previous studies such as the study of the field (2021) and the colabi (2021) and Abboud (2022), the researcher built the Imaginative thinking test consisting of ( 15 ) items of the multiple choice type with three alternatives (A, B, C) distributed in three areas and equally. The first field consists of (5) items and the second field consists of (5) items and the third field consists of (5) items .

##### ❖ **Test Instructions Setup:**

- Instructions for answering the items of the Imaginative thinking test:The instructions for the answer have been drafted so that they are clear to all students, as they included giving the students an idea of the purpose of the test as well as the type of questions, the overall degree of the test and the method of answer, and urging them to answer accurately and read the items of the test carefully. It was stressed that no item was left unanswered, and the researcher identified for each item four alternatives, and each item is answered in the question paper.

- Instructions for evaluating the Imaginative thinking test:The researcher set a score for each item on the number of answers so that the total score is equal to the sum of a skill (starting imagination, mental transformations, transforming imagination).

##### ❖ **Validity of the imaginative thinking test:**

❖ **Face validity:** It was presented to a group of arbitrators with experience in teaching methods and educational sciences to express their views and observations on the general form of the test and the validity of its items , and after the researcher obtained the observations of the arbitrators and their views, some items were amended in terms of drafting and without deleting any item thereof.

▪ **Construct validity:** The validity of the construction was found as follows :

1. **Method of relationship of item score to the overall score of the internal consistency scale**

2. Relationship of the item to the area

3-The degree of relationship of the field to other fields

The content of the test was found to be representative of the academic content.

❖ exploratory application of the Imaginative thinking test was conducted

**The test was applied in two stages: -**

##### ▪ **first survey application:**

The researcher applied the Imaginative thinking test to an initial exploratory sample consisting of(37) students from the fifth grade of primary school (Mandali Elementary School for Girls ) (without the research sample) affiliated to the General Directorate of Education in Diyala Governorate, Baladroz District, for the purpose of determining the time required to answer the test, the clarity of its items and instructions, and the diagnosis of ambiguous items of it, as it was found that the time taken to answer the test items is (45) minutes.

##### ▪ **second survey application:**

For the purpose of extracting the psychometric characteristics of the test, the researcher applied the test again to an exploratory sample of fifth grade students from the (Arabian Shima Girls School) consisting of(100) students. The application was on Thursday (13/10/2022). The researcher herself supervised the application of the test in cooperation with the teacher of the subject in this school. After correcting the answers of the students, the researcher arranged the scores descending

from the highest grade and they were (15) to the lowest grade, and then the upper and lower extreme samples were selected by (27%) as the best two groups to represent the whole sample. The coefficient of difficulty, ease, discriminating power and reliability coefficient were extracted.

#### ❖ Statistical analysis of items

The following is an explanation of the procedures of statistical analysis test items :

##### ▪ Difficulty Factor:

The difficulty coefficient was calculated for the Imaginative thinking test and it was found to be between (0.31 -0.70) and this is acceptable.

##### ▪ Discrimination Factor:

The coefficient of discrimination was calculated for the Imaginative thinking test and was found to range between (0.33-0.48) and this is acceptable.

##### ▪ Effectiveness of False Alternatives:

The researcher arranged the students' answers to the test items and distributed them between the two research groups (upper-lowest) and after calculating the effectiveness of the incorrect alternatives, it was found that they were limited between (-0.07- 0.19 -), which means that the incorrect alternatives have attracted more students from the lower group than the number of students from the upper group, and thus it was decided to keep the incorrect alternatives as they are .

#### ❖ Test reliability :

The reliability of the Imaginative thinking test was calculated using the (Kyoder-Richardson20) method. The reliability coefficient when calculated with this equation is (0.8273). The test is stable if its reliability value is (0.70) or more, and thus its value is good and acceptable, so the test is stable.

#### ❖ The final version of the test :

After the completion of the statistical procedures related to the items of the Imaginative thinking test, the test consisted of (15) test items of the multiple choice type, and the final score of the test was (15) score and thus the test is ready for application.

#### ❖ Eighth: Statistical means

The researcher used the following statistical means in the procedures of her research and analysis of her data:

1. Equation of T-test for two independent samples:
2. Square Kai (Ka2):
3. Equation of difficulty coefficient items :
4. Parameter Equation:
5. Equating the Effectiveness of False Alternatives:
6. Kyoder-Richardson-20 equation:

#### • Presentation and Interpretation of Results:

This chapter includes a presentation of the researcher's findings and their interpretation according to the hypotheses of the research and its goal and then reach conclusions, recommendations and proposals as follows: -

#### First: Presentation of results :

To verify the zero hypothesis, which states that: (There is no statistically significant difference at the significance level (0.05 ) between the average scores of the experimental group students who study a back-to-back strategy and the average scores of the control group students who study according to the usual method of Imaginative thinking ) . After applying the Imaginative thinking test to the two research groups and classifying the data, Appendix (7), the arithmetic mean, standard deviation and T-value were found using the T-test of two independent samples to compare the average scores of the experimental group's female students and the average scores of the control group's female students in the Imaginative thinking test. Table (2) shows that :



**Table (2)** For the scores of the students of the two groups of research in the test of Imaginative thinking skills (t-test) test results

| Group              | Number of sample members | Arithmetic mean | Standard Deviation | Variance | Standard error | Degree of freedom | T value    |         | Level of Significance 0.05 |
|--------------------|--------------------------|-----------------|--------------------|----------|----------------|-------------------|------------|---------|----------------------------|
|                    |                          |                 |                    |          |                |                   | Calculated | tabular |                            |
| Experimental group | 38                       | 9.973           | 2.059              | 4.239    | 0.334          | 76                | 5.795      | 2,000   | statistically significant  |
| Control group      | 40                       | 7.45            | 1.782              | 3.175    | 0.281          |                   |            |         |                            |

Table (2) shows the arithmetic mean of the grades of the students of the experimental group that studied the subject of science according to the back-to-back strategy reached (9.973) with a standard deviation (2.059), while the arithmetic mean of the grades of the students of the control group that studied the subject according to the usual method reached (7.45) with a standard deviation of (1.782) and that the calculated T-value (5.759) is greater than the tabular value of (2,000) at a degree of freedom (76) and a level of significance (0.05). This difference is statistically significant and thus rejects the second zero hypothesis and accepts the alternative. This result indicates the superiority of the students of the experimental group who study according to the back-to-back strategy over the students of the control group who study according to the usual method of testing imaginative thinking skills.

#### **Description of the magnitude of the effect of the independent variable in the dependent variable (Imaginative thinking )**

The researcher used the (Cohen) equation in extracting the size of the effect (d) of the independent variable in the dependent variable, and the amount of the effect size (d) was (0.936), which is a suitable value to interpret the size of the effect and a large amount of the teaching variable with the strategy of ( back-to-back) in the Imaginative thinking test and in favor of the experimental group, and Table (3) shows that :

**Table 3** The magnitude of the effect of the independent variable in the variable of Imaginative thinking skills

| Impact size | dValue | The dependent variable | The independent variable |
|-------------|--------|------------------------|--------------------------|
| large       | 0.936  | Imaginative thinking   | Strategy ( Back to Back) |

The researcher has determined the magnitude of the impact according to the scale developed by (Cohen)

(Cohen, 1988:276), and the previous table (2) shows this.

#### **Second :Interpretation and Discussion of Results**

The results in Table (2) showed that there are statistically significant differences between the average scores of the experimental and control group in the Imaginative thinking test and in favor of the experimental group, and this means that the students of the experimental group who studied science according to the back-to-back strategy outperform the students of the control group who studied science according to the usual method in the Imaginative thinking test. The reason for this can be attributed to:



- The application of this strategy, which relies on the interaction between the audiovisual style of the students, helped to activate the mental skills of hope and the ability to link meanings and imagine the new meaning, which helped to raise the level of imaginative thinking among the students.
- The researcher moves the imagination and makes a presentation with the presentation of the topics in front of the students and their interaction in performing the imaginary activity and increasing the discussion in the classroom, which led. To increase their thinking process and develop more modern and original ideas.
- The strategy works to build a bridge of positive communication between learners and each other in an atmosphere filled with fun, entertainment, education and development of mental skills at the same time .
- The implementation of this strategy does not require a lot of time, but the teacher sets a timeline for the learners until the first describes and the second discovers the shape and so on.
- The continuous application of this strategy enhances the degree of its benefits and its positive impact on the souls and skills of learners.

The researcher believes that the results of the research came in line with what came in the educational literature in making the learner active and effective in the educational process, because the successful educational process is the one that begins with the learner and ends with him, and despite the difference in the independent variable, the environment and the nature of the topics, the result of the current research was consistent with the rest of the previous studies in the superiority of the female students of the experimental group over the female students of the control group, such as a study (Bani Younis, 2017), a study (Al-Jurani, 2020), and a study (Al-Kulabi, 2021).

## CONCLUSIONS

After the researcher finished applying her research and analyzing and interpreting the results, she reached:

- The teaching of the back-to-back strategy has contributed to raising the level of imaginative thinking among the students of the experimental group compared to the students of the control group who study according to the usual method.

## IV. Recommendations

After presenting and interpreting the results, the researcher recommends the following :

- 1) Emphasize the need to adopt a back-to-back strategy in the teaching of science at the primary, intermediate and preparatory levels in the light of the available possibilities.
- 2) The importance of using teachers of science subject, especially the back-to-back strategy, to help them teach science to female students. This is done by conducting training courses and seminars for teachers of science, in which the back-to-back strategy is identified and how to apply it within our schools, especially in primary schools.
- 3) Develop the steps of the back-to-back strategy in the teacher training program in the faculties of education.
- 4) Develop a guide for teachers of science dealing with how to use the back-to-back strategy in the field of teaching science.

## Fifth :Proposals

Due to the results obtained by the researcher, she suggests the following :

- 1) Conducting a study to know the impact of the back-to-back strategy in Imaginative thinking and for other academic stages.
- 2) Conducting a study to know the impact of back-to-back strategy in other dependent variables such as (critical thinking, sounding thinking, convergent thinking) and others.
- 3) Conducting a study on the impact of back-to-back strategy for various other subjects such as (mathematics, chemistry, physics )

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