Scholar's Digest- Journal of Multidisciplinary Studies
Volume 3, Issue 10, October - 2024
ISSN (E): 2949-8856
Scholarsdigest.org

THE IMPACT OF POST-BRENNAN'S STRATEGY ON THE PIVOTAL THINKING OF MIDDLE SCHOOL STUDENTS IN MATHEMATICS

Sohaib shaban ismael hamza al_halboosi
Ministry of Education/Anbar General Directorate of Education
Email: suheabalhlbose@gmail.com

Mahdi saleh hamza majeed al_masoudi
Ministry of Education/Karbala Education Directorate
Email: Suraamahdi2010@gmail.com

Abstract
The current research aims to study the effect of the Post and Brennan strategy on pivotal thinking among middle school students in mathematics. The researchers adopted the experimental method, as they used an experimental design with a post-test for pivotal thinking for the two independent research groups (experimental and control). The experiment was applied to a sample consisting of Of (60) students distributed equally between the two research groups, experimental group (A) and control group (B), from the fifth scientific grade students in (Abu Jaafar Al-Mansour Preparatory School for Boys) affiliated with the General Directorate in Anbar Governorate - Fallujah Education Department for the academic year (2023-2024), The researchers conducted equivalence between the experimental and control research groups with some variables, namely: previous achievement in mathematics, intelligence test, previous knowledge, and the pivotal thinking test was constructed, which consisted of (42) objective items with four alternatives, one of which represented the correct choice, as the researchers verified its validity. Its stability was found acceptable. After completing the experiment, the pivotal thinking test was applied using the statistical package (SPSS-26). Levene's test and the t-test were adopted for two independent samples. The results showed that the students of the experimental group who were taught according to the Post and Brennan strategy outperformed the students of the control group who were taught Teaching them according to the traditional method.

Introduction

First, the problem of research:

Today's world is undergoing an evolution and a change described as the world of information and technology. Educators and community leaders face unprecedented problems with how to prepare today's students to face the difficulties of the future world. Old methods have become insufficient to cope with this acceleration in the amount of information and the diversity of knowledge sources, which has left one unable to control a fraction of it. This is why the goal of the educational process is not to reduce students' acquisition of knowledge and realities, but rather to develop their thinking abilities and acquire experiences to deal with increasing and accelerating information day by day. In the view of the researchers, there is an urgent need to keep abreast of developments in teaching methods and methods by relying on modern

teaching strategies. Adherence to traditional methods is no longer acceptable because they are no longer sufficient to meet the requirements of the educational and educational process. In particular, today's world is experiencing qualitative and quantitative leaps in all areas of life. To address this problem, the researchers believe that using the Post-Brennan strategy to teach mathematics may raise the level of pivotal thinking. The problem of research can therefore be identified by obtaining the answer to the question: What is the impact of Post and Brennan's strategy on the pivotal thinking of middle school students in mathematics?

Second: The importance of research:

1- The Post-Brinian strategy is a modern strategy that helps students to enrich their experiences by relying on themselves during the process of education rather than being indoctrinated and giving them the opportunity to contribute to the discovery of information, encourage them to discuss and ask questions to express new ideas.

2- Find out the impact of using Post and Brennan's strategy in pivotal thinking, and provide the educational library with a test of pivotal thinking.

3- The importance of teaching mathematics at different levels of study because of its importance in all fields, as it requires more attention and care in choosing strategies that work students an effective and fundamental focus of the educational process.

4- The lack of a study that addressed the impact of Post and Brennan's strategy on pivotal thinking among prep playful students in mathematics to the knowledge of both researchers.

Third: The objective of the research:

The current research aims to learn (the impact of Post-Brennan's strategy on pivotal thinking among middle school students in mathematics).

Fourth: Research hypothesis

There is no statistically significant difference at 0.05 between the average scores of the experimental group who will study according to the Post-Brennan strategy and the average students of the control group who will study according to the usual method of the pivotal thinking test.

Fifth: Limits of research:

1- Fifth scientific students in preparatory and secondary schools of the General Directorate of Education of Anbar Governorate - Fallujah Education Department.

2- The first five chapters of the math book devoted to the fifth grade Science 12, 2023.

3- First semester of the academic year (2023-2024)

Sixth: Search terms:

1- Post-Brennan Strategy: "A process of thinking through which students can discover the link between pre-learned laws, and can be applied to solve a new problem, it leads to learning" (Abu Riash, 2007, p. 296).

2- Pivotal Thinking: "As a uniformly used mental process for achieving a specific goal that contains a list of 21 basic thinking skills classified into eight main categories and the classification of thinking skills provides us with a way that students need to organize thinking specifically to become good thinkers" (nofal and Remawi, 2008, p. 33).

Chapter two: Background to theory and previous studies

First: Background Theory:

First: Post and Brennan's Strategy:

The process of resolving issues is not limited to the application of the rules and laws taught by students, but often goes beyond a new learning process. When students are exposed to a situation that contains a problem and needs to be solved, they recall and summon what they have learned, work at the height of the assumptions and proceed with a solution plan towards the desired goal. This enables them to build a strategy of resolution that can be used in new situations (Al-Sharif, 1996:69).

It should be noted that Post and Brennan's strategy is derived from the entrance to George Puglia (G. Polya) for problem solving, since problem solving is a complex mental activity because intelligence is sometimes known as problem solving, This makes problem solving a mental activity with a lot of interrelated mental processes such as visualization, imagination, remembrance, impartiality, generalization, analysis, composition, foresight, and intuitive speed. In addition to information, skills, emotional processes and general abilities such as desire, boredom and motivation (Al-Amin, 2001:244).

Post Brennan's strategy is one of the means that can prove its effectiveness in this field. Research has shown that students who have learned certain subjects using problem solving are more able to retrieve the material contained in these subjects than their peers who have learned the same subjects in the same way as usual (Alomari and saif, 2015:99).

Post and Brennan's strategy consists of the following phases:

1- Perception, clarification and understanding of the problem:

Before solving the problem, the individual needs to understand, visualize and understand the problem, and this is combined with the characteristics of both the individual and the subject of the problem. (Al-Ashqar, 2011:82), this is done by crystallizing the ambiguities and questions asked and identifying them and questioning their elements and components. The factors that led to them and the problem show only the sense of the researcher that the position needs clarification (Abdulrahman and Adnan, 2007:477).

Many researchers agreed that there are criteria that researchers can apply in identifying a sound and appropriate problem. and that it can be researched and has specifications such as authenticity and that it is not duplicative and is intended in authenticity not to use research steps or the same approach as a previous researcher, And it's possible to re-examine the same problem in specific circumstances, It must be done according to some of the special criteria, and these standards as follows:

1- Researcher's adequacy and scientific ability.

2- The problem is within the scope and care of the researcher.

3- This problem should be scientifically useful and searchable.
4- The newness of the problem and its continuation.
6- Environmental conditions and potential. (Aljabri, 2011: 73-74)
6- Move away from using the automatic method of solving problems except in the narrowest limits, and the teacher should guide his students and guide them to solve problems by urging them to read freely and access books, magazines and sources.
7- The realism of the problem has a clear meaning for both the teacher and his students, and it has an association with the subject of the study, so that everyone can contribute to its study and find solutions to it. (Zaire, Others, 2014:107)
The sensation of the problem includes determining the main objective in the form of an expected output of students with a barrier between students and achieving the desired goal, i.e. students must be aware of what they want and what refers and hinders their will, thus feeling the problem has occurred (Toalba, others, 2011:222).

This step includes the following sub-steps:
1-1- Read the problem carefully.
1-2- Search for any incomprehensible word.
1-3- Identification of teachings and ignorances
1-4- What are the conditions
1-5- Describe the problem in words.
1-6- Divide the problem into parts.
1-7- Draw a form that helps interpret and clarify. (Post & Brennan , 1976 : 59)

2- Confronting the problem ((analysis)):
This phase is made available and used to solve the problem, and the information has multiple sources for the student such as past experience, textbooks, and various references that are associated with the problem (Al-Hawidi, 2010:222).
It can be summarized in several points:
2-1- Collect data, retrieve facts and laws, and look for the necessary relationships to solve.
2-2- Retrieve missing information and test information with relationships from problem phrases, and search for new information if necessary.
2-3- Ignore information that has nothing to do with them.
2-4- Identify the activities of the entrance, by observing obstacles in solving the problem. (Al-Masoudi & hakem, 2020:173)

3- Production Phase:
In the production phase, the possibilities or temporary solutions to the problem may be successful or not in reaching a solution to that problem are not considered a definitive solution (Saadi and Yousef, 2014:122).
This phase is carried out in accordance with the following steps:
3-1- Finding the relationship between anonymous information and information, and may be done by resorting to help problems in case relationships are not perceived.

3-2- Looking for alternative assumptions, possible solutions to the problem.
3-3- Arrange the information present upon testing.
3-4- reject assumptions that did not meet the conditions of the problem.
3-5- Test the validity of the solution.
This is where the hypotheses are tried one by one so that students find the right solution, which is backed up by sufficient scientific evidence to prove valid to solve the problem. (Zaire, Others, 2014:108)

4- Ascertain the correctness of the solution:
At this point the problem owner is looking for a solution by proposing possible alternatives and these alternatives are called hypotheses, The assumptions are a solution that needs to be applied and in order for the problem holder to propose alternatives and assumptions, it is necessary to analyse the problem and collect data and information related to the problem in terms of the factors affecting it and its causes. Alternatives and assumptions usually emanate from the underlying causes of the problem. The reason has turned from the type of question sentence into an informative sentence (Toalba et al. 2011:65).

This is done through the following steps:
4-1- Acceptance or rejection of the imposition to verify that it complies or does not comply with the conditions of employment
4-2- Review Can the validity of the assumptions be tested? Can the result be concluded in another way? Can the result be used? Or how to solve some other problems? If you refuse to impose, choose another one and test. (Post & Brennan , 1976 : 60)

Second Theme: Pivotal Thinking:
The primary objective of the development of pivotal thinking is to enable students to learn ways of obtaining knowledge and not only to learn information (Galyarn, 2003, 84).
The thinking skills enable students to achieve the best benefit from the knowledge that students get and the experiences they have experienced or the knowledge they receive from those around them (Mathews, 2006, 2).
Marazano and his colleagues identified 21 thinking skills in eight categories as follows:
1- Focus skill: It is related to an individual's ability to understand the problem or information that is important to the subject of thinking. This skill is divided into two skills:
1-1- Problem Definition Skill: This skill refers to the work of clarifying the distinctive situations of questioning by the student and usually includes answering the following questions: What is the problem of the subject matter? Who has a solution to the problem?
1-2- Goal-setting skill: This skill is aimed at identifying educational outcomes that we expect students to reach after experiencing educational experience or a confusing scientific attitude (Marzono et al., 2004:165).

2- Information Collection Skill:
is to obtain the desired or appropriate information and is based on two skills:

2-1- Note: Students get information through one or more senses or are conscious, accurate and intended viewing of any phenomenon, trying to understand it, analyzing it to learn its details and getting information using one or more sensors (Attiya, 2015, 321)
2-2- The skill of asking questions: is getting new information by drafting new questions.
(Al Qawasma and Abu Ghazal, 2013:243).

3- Memory skills:
a number of activities or strategies that students work with the aim of storing and retaining information in long-term memory. This skill includes two skills:
3-1- Coding skill: the process of connecting small pieces of information with some to save them in long-lasting memory. (Marzono and Others, 2004:88)
3-2- Retrieval skill (recall): intellectual skill through which previous information is called in long-term memory (Marazano and et al.. 1988 , 77) .

4- Organization skill:
organizing and arranging information to make it easier to understand in a more effective manner, and includes:
4-1- Comparative skill: A fundamental mental skill to organize information and develop knowledge and must have a standard to rely on to show the difference between two different or similar things. (Alaziz, 2013, 165)
4-2- Classification skill: Knowledge of common characteristics of all vocabulary of a particular group or family that are not available in the vocabulary of a family or other category of objects or objects, and find a method or system for separating the vocabulary into categories that distinguish it from other families or categories.
(Mustafa, 2013:42)
4-3- Ranking skill: This skill means subjecting elements or vocabulary to regulation according to a specific criterion or is a serial vocabulary according to a predetermined criterion (Attia, 2015:222).
4-4- Representation skill: This skill reformulates information and expresses it in a way that shows the important relationships in its elements by transforming it into planning forms, tables, charts or graphic forms (Al-Rabi and others, 2013, 126).

5- Analytical skill:
This skill represents an individual's ability to analyse information to its components and to understand the interconnections between information and includes the following skills:
5-1- Skill in identifying characteristics and components: It is possible to identify characteristics or parts of something using the knowledge bases stored for it and then work to clarify which parts are all.
5-2- The skill of identifying relationships and patterns: It is intended to identify by connecting components.
(Gilroan, 2013:53)

5-3- The skill of identifying key ideas: intendedThis skill is the ability to perceive part function and relationship to other parts (Obeidat and Sahila, 2007:92).

5-4- Skill identification of errors: This skill is based on the detection of errors in the logical presentation which is another that includes a set of accounts, procedures and information (afana and taiseer, 2018:119).

6- Obstetric skills:

They represent the production of new meanings, information and ideas and consist of the following skills:

6-1- Evidentiary skill: This skill is defined as a type of extractive and extrapolatory proof, since the deductive proof is the individual's ability to identify an existing principle in a logical way.

(Abu Jado, 2010, 99)

6-2- Prediction skill: The learner's ability to create expectations for upcoming events based on his or her information and new ideas (Alotom and others, 2014:224).

6-3- Elaboration skill (expansion): The learner's ability to add new details and relevant information or examples.

7- Integration skill:

One of the main or pivotal skills in teaching thinking to arrange or develop interrelationships between them that lead to a deeper understanding of those relationships, and include two sub-skills:

7-1- Summary skill: An individual's ability to extract basic ingredients is a text by forming a set of coherent phrases that give a clear meaning in the mind of the learner.

7-2- Rebuilding skill: This skill is defined as the process of knowledge structure directed towards the integration of new information. The teacher carries out, according to new things, activities through which he seeks to expand, reorganize or reorganize the educational material with a view to abandoning the preceding concepts of partnering that facts, perceptions, beliefs or trends are no longer true or accurate. (Abu Jadu and Nofal, 2007: 106-109)

8- Calendar skill:

This skill is the learner's ability to judge the reasoning and quality of thinking and includes two skills:

8-1- Standard-building skill ("test formation"): The skill of the test formation indicates the setting of a set of touchstones on the quality and value of ideas. These touchstones are based on a set of rational principles derived from academic level, experiences or the rule, or by simple phrase standard or indicator used to judge a particular object.

8-2- Verification skill: This skill enables the individual to ascertain the accuracy of the allegations made about a particular case.

(Abu Jado, 2010:107)

Second: Previous studies:

1- Post-Brennan Strategy: There are no studies on Post-Brennan's strategy in mathematics as far as the two researchers know.

2- Studies on pivotal thinking:

A- Study (Al-Adami, 2018): The study aims to know the impact of a proposed strategy on a model (Eddie and Shire) In the achievement and pivotal thinking of middle first graders in mathematics, I used the experimental curriculum, and the study sample consisted of (63) Student Pilot House Distributors (32) and Female Officers (31). The study tool was a test of collection and another of pivotal thinking. The results showed that the pilot group's students exceeded both tests.

B- Study (Nasser, 2020): The study aimed to know the effectiveness of using Treagust in the acquisition of mathematics and pivotal thinking skills in middle second graders. It used the experimental curriculum. It consisted of 64 students distributed equally. The study tool was the two tests of achievement and pivotal thinking. The results showed that the pilot group students outperformed the control group in both tests.

C- Study (Al-Marashidi, 2022): The study aimed to know the impact of the learning acceleration model on the achievement of mathematics and the pivotal thinking of middle third graders, used the experimental curriculum and formed the research sample of (70) A student distributed equally to the experimental and control research groups, the study tool was the two tests of achievement and pivotal thinking, and the results showed that the students of the experimental group outperformed the control group in both tests.

The current research has agreed with some previous studies in some respects, including the pilot curriculum, the parity of the two research groups and the difference in sex and school level.

Chapter three: Research procedures

1- Research curriculum: The two researchers adopted the experimental curriculum to achieve research objectives.

2- Experimental design of research: The two researchers adopted one of the experimental partially adjusted designs of two independent, equal and dimensional test groups, to fit the current research, table (1):

Table (1): Experimental Design

Test type	Dependent variable	Independent variable	Parity of the two groups	Group
Pivotal thinking test	Pivotal thinking	Post-Brennan Strategy	IQ test – Previous collection – Previous knowledge test	**Experimental**
		traditional metho		**Control**

3- Research community:

Fifth-grade scientific students were selected for secondary and day preparatory schools under the Department of Fallujah Education - General Directorate of Education in Anbar Governorate, for the academic year (2023-2024). The total number of students for fifth-year scientific schools (3,817) distributed among (10) boys' secondary schools and (13) boys' preparatory schools (6) mixed secondary schools.

4- Research sample:

The research sample was distributed evenly experimental (30) students and female officers (30) students from the Fifth Scientific Students and randomly selected as group (a) experimental and (b) officer from the preparatory students of Abi Jafar al-Mansour Boys.

5- Control Procedures:

5-1- Internal Safety: For the purpose of parity of the two research groups the two researchers worked at the calculation of the average computational data of variables (IQ test, previous attainment, previous knowledge test) The researchers also used Levine's test for two separate samples to calculate the difference between the variability of data of each of the two research groups variables, as this data was found to be homogeneous in all of the variables mentioned because these variables are greater than the level of indication. (0.05), and test (t-test) for two separate samples to determine the average difference of each of these variables mentioned for the research groups, since there are no statistically significant differences because the level of indication for these variables is greater than the approved level (0.05).

5-2- External safety of experimental design:

5-2-1- Duration: The duration of the experiment is equal for the experimental and control research groups starting on Sunday 1/10/2023 and ending on Wednesday 17/1/2024.

5-2-2- Teacher Article: The two researchers are keen to teach the two research groups from the same teacher, to avoid what may happen to different teachers because of their different style, abilities and skill.

5-2-3- Number of classes: Number of classes for the fifth grade in mathematics is (5) attendance classes for each of the two research groups.

5-2-4- Study subject: The course consisted of the first five classes of the math book for the fifth grade of science, to be taught for the academic year 2023-2024, 12, 2023.

5-2-5- Experimental breakdown: No students from the experimental and control groups were dismissed or left the school.

5-2-6- Factors related to the maturity of students in the sample: the duration of the experiment is relatively average and therefore these variables did not have an effect on the experience, as students at a particular school stage are close in age and close in biological and psychological maturity.

6- Research tool:

A tool to measure pivotal thinking (subordinate variability) has been developed to find out the research's verification and hypothesis. The researchers have prepared this test according to the following steps:

6-1- Determining the objective of the test: The objective of this test is to know the level of pivotal thinking in the fifth-grade scientific students of the experimental and control research groups and the comparison between the two groups.

6-2- See previous studies and literature: The two researchers saw some literature and previous studies that dealt with pivotal thinking such as the study (Al-adami, 2018), (Nasser, 2020) and (Al-Mrashidi, 2022) and the researchers' benefit in identifying pivotal thinking skills and drafting test paragraphs.

6-3- Identification of pivotal thinking skills: by reference to the literature of this variable and studies, pivotal thinking skills were determined by (8) main skills and 21 subskill of pivotal thinking, measured by the test in fifth-grade scientific students.

6-4- Formulation of pivotal thinking test paragraphs in the light of specific areas: The researchers drafted the test paragraphs for each area to be compatible with each other's theoretical definition so as to be appropriate to the level and abilities of fifth-grade scientific students and consisted of (42) multiple selection type paragraphs.

6-5- Presentation of the test to the arbitrators: The two researchers worked on presenting the test paragraphs with skills on a number of arbitrators and specialists in the teaching methods of mathematics and psychology, and some paragraphs were amended that received an agreement ratio (80%) of the arbitrators' opinions.

6-6- Preparation of test instructions:

6-6-1- Answer Instructions: The instructions for the answer to this test for students of Science V are set out in the introduction to the test. These instructions indicate the nature of the test, what it is intended and how to answer it, as well as the development of some indicative phrases such as leave no paragraph without answering, not choosing more than one alternative.

6-6-2- Correction instructions: The two researchers set a key that clarifies in the correct answer to each of the test paragraphs, where one score was placed for each correct answer and a whistle for the wrong answer, the left paragraph or the paragraph for which more than one alternative was selected and included the test (42) An objective paragraph of multiple selection type and the overall degree of testing is (42) degrees.

6-7- Exploratory application:

6-7-1- First reconnaissance sample: For the purpose of ascertaining the clarity of the test paragraphs and instructions and to determine the appropriate test time, the researchers applied the test to a first reconnaissance sample. (36) Student of Fifth Scientific Students in the Preparatory of Progress for Boys, on Tuesday 26/12/2023 of the Directorate General of Anbar Education - Department of Fallujah Education, showing that the test and its instructions are clear to students and the students took time ranging from (56 - 80) minutes after which the calculated average time was calculated to be (68) minutes of the response time.

6-7-2- Second survey sample: The test is ready to be applied again after confirming the clarity of its paragraphs and determining the time of the answer. The researchers applied the test to a second survey sample consisting of (362) Student of Al-Fallujah, Jaber bin Hayyan Boys, Al-Najah Boys' High School and Al-Nabagh Boys' Secondary School of the Directorate General of Anbar Education - Fallujah Education Department, on Wednesday and Thursday 28-27/12/2023.

6-8- Statistical analysis of test paragraphs:

The two researchers conducted statistical analysis after the second exploratory application as follows:

1- Correct test papers.

2- In order to arrange the test papers an upward order from the lowest to the highest.

3- Then the higher group grades were sorted by 27% to be the number of students in the higher group (98) students and lower group grades by 27% to be the number of students in the lower group (98) for the purpose of statistical analysis.

6-8-1- The difficulty factor of the axial thinking test paragraphs: The difficulty factor of the test paragraphs was calculated, and was found to be between (0.26-0.69) so the difficulty factor of all test paragraphs is acceptable.

6-8-2- The distinction force of the pivotal thinking test paragraphs: when calculating the determination factor of the test paragraphs, it is found to be between (0.31-0.69) since the test paragraphs are good if they are the force of their distinction (0.30) and more (Eble,1972; 40) .

6-8-3- The effectiveness of alternatives: the two researchers used the law of the effectiveness of erroneous alternatives and found that all their transactions were negative. This shows that all alternatives attract more answers to them than lower group students compared to higher group students' answers.

6-9- Test stability:

The two researchers used the Alfa _ Kronbach equation to find the stability of the pivotal thinking test and found the stability of the test (0.86). This consistency is a good stability, as the test is well established if it finds its value (0.67) or more (Tuberculosis, 2004:240).

6-10- Application of the test:

The researchers applied the pivotal thinking test to the experimental and control research groups at the same time on Wednesday 17/1/2024. The researchers were keen to inform the students of the date of application of the test a week before.

Chapter four: Presentation and interpretation of results

1- Axial Thinking Test Results: Zero hypothesis results: (There is no statistically significant difference at 0.05 between the average scores of the experimental group to be studied according to the Post-Brennan strategy and the average of control group students to be studied according to the usual method of the pivotal thinking test)). After correcting the students'

answers in the pivotal thinking test that applied the researchers to the experimental and control research groups, the researchers used the statistical program (SPSS) version 26 to find out the statistical description of the data for the pivotal thinking test after applying it to the two research groups, as the results are shown in table (2):

Table (2) Statistical description of data of the two research groups in the pivotal thinking test variable

95% period of trust in the computational medium		Standard arithmetic average error	Standard deviation	Average	Num of students	The group
10.097	0.24	1.77	9.71	26.93	30	**Experimental**
10.097	0.24	1.71	9.36	21.77	30	**Control**

When Levine's Test is applied for two independent samples, which in turn shows the difference indication of the variation of the grades of the students of the experimental and control groups. (F) (0.003) at the indicator level (0.96) and this level is greater than the level (0.05) Approved, this shows that the experimental and control groups are homogeneous in the axial thinking variable, and when applied test (t _ test) for two independent samples which shows the difference between the two averages of the test and control groups, showing that the calculated T value (t) (2.098) at a level of 0.04)) and this level is below the level (0.05) adopted with a degree of freedom (58)), as shown in table (3):

Table (3): Value (t) and (f) for the two groups (experimental and control) in the pivotal thinking variable

Statistical significance (0.05)	t-test		Leven-test		Free degree	Variable
	Level of indication from the parties	T	Significance	F		
Function	**0.04**	**2.098**	**0.960**	**0.003**	**58**	**Pivotal thinking**

From the foregoing, there are statistically significant differences in the average grades of the students of the experimental and control groups. This leads us to reject the zero hypothesis and accept the alternative hypothesis of the (There is a statistically significant difference at (0.05) between the average scores of the experimental group to be studied according to the Post-Brennan strategy and the average students of the control group to be studied according to the usual method of the pivotal thinking test)) and for the benefit of the experimental group with the largest computational average.

1- Conclusions:

A- Teaching mathematics using the Post-Brennan strategy helped raise the level of pivotal thinking among fifth-graders.

B- Note the cooperation and interaction of the students of the experimental group who studied in accordance with the strategy of Post and Brennan more than the interaction of the control group who studied in the traditional way.

2- Recommendations:

A- Use Post and Brennan's strategy to teach mathematics and move away from traditional methods that concern teachers and neglect learners.

B- To invite the competent authorities of the Ministry of Education to conduct training courses on how to use the Post-Brennan strategy.

References

1. Abu Jadu, Saleh Mohammed (2010): teaching theoretical thinking and practice, t2, Al Masirah Publishing and Distribution House, Amman Jordan.
2. Abu Jadu, Saleh and nofal, Muhammadu Bakr (2007): Teaching theoretical thinking and practice, T1, Al-Masirah Publishing and Distribution House, Amman, Jordan.
3. Abu Rayash, Hassan Mohammed, 2007: Knowledge Learning, Al Masirah Publishing House, Amman, Jordan.
4. Al-Ashqar, Faris rateb (2011): Philosophy of Thinking and Theories in Learning and Education, T1, Zahran Publishing and Distribution House, Amman, Jordan.
5. Al-adami Mays Aladdin (2018): The impact of a proposed strategy on the model (Eddy and Shire) in achievement and pivotal thinking among middle first graders in the subject of mathematics, (Master's thesis) Faculty of Education for Pure Sciences Ibn al-Haitham, University of Baghdad.
6. Al-Amin, Ismail Mohammed (2001): Methods of teaching mathematics (theories and applications), Dar al-Arabi Thought, Cairo, Egypt.
7. Al-Jabri, Kazim Karim Reda (2011): research curricula in education and psychology, Faculty of Basic Education, Baghdad, Iraq.
8. Jalarwan, Fathi Abdulrahman (2013) Learning Thinking Concepts and Applications, Q6, Dar Al-Thawr Publishers and Distributors, Amman, Jordan.
9. Al-Rabaie, Mahmoud Daoud and Al-Shammari, Mazen Abdul Hadi and Al-Tai, Mazen Hadi Quzar (2013): Theories of Learning and Mental Processes, T1, Dar Al-Bookshop, Beirut Lebanon.
10. Zayer, Saad Ali, Dawood Abdulsalam Sabri and Mohammed Hadi Hassan (2014): General teaching methods, Safaa Publishing and Distribution House, Amman, Jordan.
11. Al-Saadi, Youssef Falih and Yousef Fadil Tamimi (2014): Basic concepts in the teaching of science, I., Scientific Books House for Printing, Publishing and Distribution, Amman, Jordan.
12. Al-Sharif, Ahmed al-Arifi, 1996: The entrance to teaching mathematics, Open University, Tripoli - Great Jamahiriya.

13. Toualba, Hadi, Bassam Al-Sarayra, Nasrin Al-shamlia and Khalid Al-Sarayra (2011): Teaching Methods, I-5, Al-Masirah Publishing, Distribution and Printing House, Amman, Jordan.
14. Abdul Rahman, Anwar Hussein and Adnan Haqqi Zankanah (2007): Methodological patterns and applications in humanities and applied sciences, Al Wifaq Printing Company, Baghdad, Iraq.
15. Obeidat, dokhan and Sahila, Abu al-Sayed (2007): Brain, Learning and Thinking, I., Dar al-Thawr Publishing and Distribution, Amman, Jordan.
16. Al-Atom, Adnan Youssef and Alwanah, Shafiq Falah and Al-Jarah, Abdelnasser Dayab and Abu Ghazal, Maaouya Mahmoud (2014): Theoretical educational psychology and practice, Q5, Al-Masirah House for Publishing, Distribution and Printing, Amting, Amman, Jordan man, Jordan man,
17. Al Aziz, Said Abdul (2013): Teaching thinking and his skills for scientific training and applications, T3, Culture House for Publishing and Distribution, Amman, Jordan.
18. Attiya, Mohsen Ali (2015): Thinking his types, skills and educational strategies, I, Dar Al Safa Publishing and Distribution, Amman, Jordan.
19. Afana, Izzo Ismail and Taseer nshwan (2018): Modern Strategies in Thinking Education, 1, Samir Mansour Library, Gaza, Palestine.
20. Al-omria, Salahuddin and saif Al-omaria (2015): Teaching Methods of Science, I., Al-Nasr Al-Sharif, Amman, Jordan.
21. Al Qawasma, Ahmad Hassan and Abu Ghazaleh, Mohammed Ahmad (2013): Developing learning, thinking and research skills, Safa Publishing House, Amman, Jordan.
22. Marzono, Robert and Nshwan, yakoub Hussein and Khattab, Mohammed Saleh (2004): Dimending Thinking Framework for Curriculum and Teaching Methods, Translating Jacob Nshwan and Mohammed Khattab, T2, Al Furqan Publishing and Distribution House, Am, Jordan.
23. Marashidi, adra Radi Jawad (2022): The impact of the learning acceleration model on the achievement of mathematics and pivotal thinking among third-grade middle students (master's thesis) Faculty of Education for Pure Sciences Ibn al-Haytham, University of Baghdad.
24. Al Masoudi, Mohammed Hamid Mahdi and hakim of Musa Abdul Khadeer Al Hasnawi (2020): Applied Therapeutics for Modern Teaching New Vision, T1, Methodological Printing House, Amman, Jordan.
25. Mustafa, Nimr Mustafa (2013): Developing thinking skills, T1 Dar Abida, Publishers and Distributors, Amman, Jordan.
26. Nasser, Nour al-Hayat Hassan (2020): The effectiveness of using Treagust in the acquisition of mathematics and pivotal thinking skills among middle second graders, (Master's thesis) Faculty of Education for Pure Sciences Ibn al-Haytham, University of Baghdad.
27. Al-Nabhan, Moses (2004): Fundamentals of measurement in behavioral sciences, I., Al-Sharq Publishing and Distribution House, Amman, Jordan.

28. Nufel, Muhammadu Bakr; Al-Rimawi, Mahmoud Odeh, 2008: Practical applications in the development of thinking, Oman, Al-Masirah publishing house.
29. Al-Huaidi, Zaid (2010): General Science Teaching Methods in the Basic Stage, University Books Publishing House, Al Ain, United Arab Emirates.
30. Eble, R. L. (1972) : Essentials Of Educational Measurement Englewood Cliff, New Jersy.
31. Galyarn, Nelly (2003) : Teaching of thinking skills to learning , international, Journal of special.
32. Marazano R .J & others (1988) : Dimension of Thinking A-frame work for curriculum and Instructiin. ASCD, Alexandrin U.S.A.
33. Mathews, D.B. (2006) : the effect of thinking skills program on the cognitive abilities of middle school student, clearing house,vol. (65), 5.
34. Post , R. & Brennan , L . (1976) : An experimental study of effectiveness of formal versus an informal presentation of a general Heuristic Process on Problem Solving in Tenth - Grade Geometry , Journal for Research in Mathematics Education , Vol. (7) , No. (1).