A PROPOSED STRATEGY BASED ON BRAIN-BASED LEARNING AND ITS EFFECT ON ACHIEVEMENT AND TRANSFER ENGINEERING FOR SECOND-GRADE MIDDLE SCHOOL STUDENTS IN MATHEMATICS

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Abstract

The aim of the research is to know the use of a proposed strategy based on brain-based learning and its effect on achievement and conversion engineering for second-graders middle school students in mathematics. To achieve the goals of this research, the researchers adopted the experimental approach. Since the current search included a separate variable and two dependent variables, I used the experimental design with two groups (experimental and control).

With the post-test, the experiment was applied to the second intermediate class students in (Al-Ma’ali Secondary School for Girls) for the academic year 2018-2019, and the research sample consisted of (81) students who were randomly divided into two experimental groups consisting of (40) students, and they were studied according to strategy (Brain-based learning) and the control group, and it consisted of (41) students who studied according to the usual method. The two groups were rewarded in the variables (time age calculated by months and test of previous mathematical knowledge and previous achievement in mathematics). The experiment was applied in the second semester (second course) For the academic year (2018-2019), the research resulted in a statistically significant difference between the mean scores of the experimental group and the control group in the achievement test in favor of the grades of students of the experimental group, and there is a statistically significant difference at the level of significance (0.05) between Average score for the experimental group and the control group in the conversion engineering test in favor of the grades of the experimental group students.

Keywords: Learning, Students, Achievement, Mathematics, Engineering.

Research Problem

The educational environment is predominantly dominated by tension in the teaching of mathematics, and the threat of the teacher in addition to the psychological pressures faced by both the student and the teacher. You face them in life and develop their mental abilities, and this motivates researchers to use a teaching strategy according to the theory of brain-based learning, so it may contribute to solving a realistic problem that our students suffer from, and it can be summarized by the following question:

What is the effect of a proposed strategy according to brain-based learning on achievement and transfer engineering among middle school students in mathematics?

Importance of Research

The importance of research can be summarized in two aspects:

1) Theoretical aspect:
   A: An attempt to increase the motivation and activity of learners towards the learning process through positive interaction with the subject matter through the use of a teaching strategy according to the learning theory of the document for the brain.
   B: Mathematics teachers may benefit from this research by looking at more information related to brain-based learning and the importance of that theory and how to benefit from it in the educational process and work to raise the level of learners' achievement by looking at their strengths and weaknesses.

2) The practical side:
   A: The results of this research can be used by the Ministry of Education when building curricula by employing and stimulating the two hemispheres of the brain together in the school curriculum.
   B: Knowing the effect of using brain-based learning on achievement and transfer engineering for middle school students through the tests that will be prepared for that.
Objectives
Research hypotheses:
For the purpose of achieving the objectives of the current research, the following zero hypotheses have been developed:

1. There is no statistically significant difference at the level of significance of 0.05) between the average scores of students of the experimental group (who will study mathematics subject to them using a proposed strategy according to brain-based learning) and the scores of students of the control group who will study the same subject using the usual method in the achievement test.

\[ H_0: \mu_1 = \mu_2 \]
\[ H_1: \mu_1 \neq \mu_2 \]

2. There is no statistically significant difference at the level of significance 0.05) between the average scores of students of the experimental group (who will study the mathematics subject determined by them using a proposed strategy according to the brain-based learning) and the degrees of the students of the control group who will study the same subject using the usual method in the test of transformational engineering.

\[ H_0: \mu_1 = \mu_2 \]
\[ H_1: \mu_1 \neq \mu_2 \]

Research Limits
The current research is determined by the following:

1. Students of the second intermediate class for the academic year (2018-2019) in the morning and middle schools and high schools in the city of Baghdad of the Baghdad Education Directorate / Rusafa 2.

2. The fifth and sixth semesters of the book of mathematics (Part Two), to be taught for the second intermediate and second semester.

Defining the Terms

Teaching strategy: defined by:
- He defined it (Zaytoun, 2009): “It is a set of procedures and steps that the teacher pursues within the classroom, according to the goals previously set in order to reach the required outputs, including the methods, activities, means, and methods of evaluation” (Zaytoun, 265: 2009).

- (Odeh, 2014) as (a set of means that came out of a series of tests used to achieve and achieve the goals set) (Odeh, 2014: 7)

Brain Learning: Known by:
- (Caine & Caine, 1997): that (it is a type of modern learning based on knowledge of the rules of the brain and organizing education according to those rules and thus assisting him in carrying out his operations naturally in order to obtain meaningful learning and more effective). (Caine & Caine, 1997: 132)

- (Zaytoun, 2001): That it is (an understanding of the learning process based on brain functions and the way it works, and the learning process occurs when the brain is allowed to complete its natural processes). (Zaytoun, 2001: 5)

The researchers agree with the definition (Zaytoun, 2001) as a theoretical definition consistent with this research.

Achievement: Known by:
- (Abu Gado, 2003): As (the result of what the learner learns after passing a specific time period for learning to know the success of the strategy that the teacher used and plans to achieve his goals and can be measured by the degree obtained in the achievement test). (Abu Gado, 2003: 469)

- (Hamadenah and Khaled, 2012): that it is (an organized procedure that is carried out according to specific criteria set in advance aimed at learning about the facts, concepts and skills acquired by the learner after studying a specific study subject). (Hamadenah and Khaled, 2012: 147)

The researchers define it procedurally as (the final total score obtained by the student through her answer to the achievement test prepared for the purposes of the current research).

Conversions engineering: defined by:
- (Al-Karmi, 1998) as (basic requirements for crystallizing the educated thinking towards a correct direction, its ability to perceive relationships in the situations facing it and the ability to choose alternatives and organize available ideas and experiences to reach new ideas) (Al-Karmi, 19: 1998)

- (Maliha, 2003) It is (the process of transferring curves and geometric shapes from standard position to other conditions in order to preserve their characteristics) (Maliha, 26: 2003)

The researchers define it as (the total score obtained by the student through her answer to the conversion engineering test, not for the purposes of the current research).

Brain Based Learning Theory
The theory of brain-based learning has emerged in the nineties of the last century, one of the recent educational trends in modern educational thought. Modern technology has contributed to depicting a mechanism of work and its structure
neuroscientists explain the occurrence of the learning process, where learning occurs when the brain is able to complete its natural processes. (Jensen, 2000: 26)

It included a link for the educational process with learning theories, a close link necessary to follow the latest developments in this field, my ear, from the viewpoint of those interested in the field of education, it is no longer acceptable that a few class of learners reach the degree of competence to keep pace with contemporary developments of society, so they agreed on a fundamental goal they seek to achieve, which is to reach the learner To master the academic subject, therefore, it must be harnessed for the sake of that all capabilities, starting with the educational goals set, curricula, activities, modern educational education, the teacher, teaching methods, and evaluation of all this in order to help all or by using the learners in order to reach the desired stage in the learning process. (Katame and Mashaala, 2007: 56)

The results of research in the areas of the two sides of the brain have concluded that the individual does not have one brain, but has two halves, each of whom does his work in a different way from the other in processing information, as the right half is specialized in installing and reconstructing the separate parts by identifying the relationships between those parts to be in an integrated manner. The left side of the brain is linear, as it analyzes the parts that make up the patterns.

The brain-based learning theory is distinguished from other theories by several things, including:

• It is a way of thinking about teaching and learning because it is a natural and permanent way of thinking methods that the learner has.
• The basis of the work of this theory is based on the structure and function of the brain.

(Ubaid and Afana, 2003: 117)

General principles for brain-based learning:

There are a number of principles upon which the brain-based learning theory is based and summarized. (Caine & Caine, 1994) with a number of points, including:

1. When the brain receives information, it innately searches for it in this process through different patterns and can contribute to understanding and clarifying this information by using teaching strategies that are consistent with the brain’s mechanism of action.
2. That the teaching process includes both focus, attention and awareness, that is, the brain acquires the most important stimuli, and that is, that meets its needs. Therefore, the learning process must be organized according to these components.
3. Each individual whose brain is organized in a unique way that differs from the other, so we see individuals realize the world around them in different ways according to their sensory inputs and the diversity of their sensory, social and cultural backgrounds. (Caen and Caen, 1994: 95)

Educational techniques associated with brain-based learning:

• This theory contributes to providing learning environments that help to immerse learners in realistic educational experience that is meaningful to the learner.
• Learning based on this theory has a major role in eliminating feelings of anxiety and fear while facing environmental challenges.
• Providing active processing of information by allowing the learner to consolidate and consolidate information through active processing of it. (Zaghloul and Mahamid, 2007: 43)

Some educators believe that brain-based learning is linked to three basic elements:

• Teacher: It is responsible for creating educational experiences and attitudes that are in harmony with the brain.
• The learner: It is the party that must have the personal motivation and the desire to challenge in order for the brain-based learning process to take place.

Active treatment that the brain performs with the information it receives so that it can deal with it according to its mechanism of action. (God's kindness, 2012: 220)

Characteristics of brain-based learning theory:

The brain-based learning theory is based on a number of characteristics, the most prominent of which are:

1) This theory is a method of thinking about learning and teaching.
2) This theory is an existing system in itself and not a design that was previously prepared by a specific person. It is based on an understanding of the workings of the brain's structure and function.
3) Learning according to this theory is a positive and natural way to organize the ability to teach and learn. (Mahmoud, 2006: 287)

The brain-based learning process includes a number of stages. The two researchers summarized them as follows:

• Preparation stage:

This stage is based on providing a preparation for the new learning, as it includes forming an idea about the subject and a mental perception of other related topics. The role of the teacher here is the necessity of providing a classroom environment that is enriching that pushes the learner to
challenge and compete and thus such an environment contributes a great role in preparing minds for the new topic of Through links with previous experiences. (Youssef, 2011: 109)

- **The acquisition stage (direct and indirect learning)**
  This stage consists in creating neurological connections as a result of the original, interrelated experiences possessed by the learner, and the stronger the inputs, the stronger the neurological connections are. The primary sources for this stage are discussion, lecture, various environmental stimuli, as well as reading and participating in group projects.

- **Elaboration detail stage:**
  This stage is the interdependence of topics and the deepening of understanding. This stage is supported by the involvement of learners in various educational activities in order to achieve a deeper understanding of the important things that contribute to the enrichment of this stage visual tools and the keys to answer and immediate feedback. (Willis, 2007: 112)

- **Memory Formation stage**
  The goal behind this stage is to strengthen the learning process, i.e. learning time and retrieve information better and easier. The role of the teacher comes here through the process of providing adequate comfort for the learner and reducing emotions and working to present evaluation questions to learners in a beautiful and interesting way. (Al-Salti, 2004: 104)

- **Functional Integration**
  This stage is based on the use of what has been learned recently by the learner in order to enhance it more, deeper and easier because of the presence of cross-linked neuronal connections in neurons. At this stage, the teacher must raise topics related to the following topics so that the learner can form bonds in the brain and work to strengthen these interconnections through multiple applications to new learning. (Engle & Gathercole, 2008: 81)

The nature of the mathematics methods used that tend to encourage the learner to discover ideas and solutions on his own generate a feeling of desire and contentment and work to continue working and learning and for this kind of learning to be achieved the teacher must give way to learners to discover new ideas themselves even if that takes a long time of it And also, through the use of various educational activities that make the learner accept the educational process with desire and be a positive trend towards the learning process because mathematics is based on the activity. (Al-Hassani, 2014: 82)

Conversions engineering is one of the components of general mathematics curricula, as engineering occupies the largest part of mathematics (physical) content, and it has a clear role in learning mathematics, since many learners have the desire to see and enjoy it, unlike many other mathematical topics that tend to abstain with a degree Great and not easy for the learner to handle. (Abu Lum, 2005: 145)

Some believe that engineering knowledge was useful and important in daily life as it contributes to the representation and description of the system in which the learner lives in a regular way and has a great role in visualization and thus helping the learner to increase the ability to express.

From here we see the necessity of reformulating the content of school mathematics textbooks and their topics in order to transfer mathematics from the formal image to the life image and this is achieved according to following modern teaching strategies such as learning strategy based on both sides of the brain as well as searching for modern educational formulas that contribute to motivating the learner and help in forming positive directions for him towards Learning mathematics and the necessity of organizing the content according to the knowledge structure of it at every stage of education. (Al-Qahtani, 432: 2015)

**The importance of teaching engineering:**
Improving the level of thinking in the engineering field for learners is one of the main goals in teaching mathematics, because of the importance of engineering in the scientific, technical and professional fields, since engineering is not just a branch of mathematics but it is considered as the basis and roots because of its role in focusing on the visual expression that addresses the eye The mind is an addition to what the engineering role adds to the development of different thinking styles and justification skills for learners as well as its role in discovery and problem solving. (Abu Amira, 1996: 225)

**The importance of studying conversion engineering can be summarized as follows:**
1) The engineering of conversions is part of public life in addition to its role in describing, understanding, and representing the natural world, so it contributes to the learner acquiring a kind of thinking that is only available to him by studying engineering, dimensions, and engineering shapes.
2) From the viewpoint of many learners, studying transformational engineering is a kind of pleasure and contributes to providing them with many
opportunities in thinking and problem solving processes and the transmission of the impact of learning on different life situations. (Al-Sawai, 2004: 45)

**Suggested Strategy Steps**

- **Preparation stage:**
  In this stage, the preparation for the new post is made, and the role of the teacher in this stage is to provide the appropriate classroom environment that makes the learners active participants.

- **Learning Stage:**
  At this stage, the new subject that the learner received is linked to the previous subject through many environmental stimuli that the teacher uses.

- **Deepening Understanding:**

  This stage is based on the inclusion of learners in various educational activities in order to achieve a deeper understanding.

  - **The integration phase:**
    This stage is based on the use of what the learner learned more and more deeply by solving new problems that depend on what he previously learned and the teacher at this stage must raise topics related to the following topics so that the learner can form bonds in the brain and work to strengthen these linkages.

**Research Methodology**

I used the experimental approach to its relevance to the current research.

**Research Design**

The researchers used the experimental design of partial control of the equivalents groups as shown in Table (1) as follows:

<table>
<thead>
<tr>
<th>The group</th>
<th>Equal groups</th>
<th>Independent variable</th>
<th>Dependent variable</th>
<th>The tool</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>• Lifetime. • Previous achievement • Previous mathematical knowledge</td>
<td>The proposed strategy</td>
<td>Achievement Conversion Engineering</td>
<td>Achievement test Conversion Engineering Test</td>
</tr>
<tr>
<td>Control</td>
<td></td>
<td>The usual way</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**The Research Community and Its Sample**

Like the research community (14367) students in the Directorate of Education in Baghdad, Rusafa / 2, and the sample included (82) students from the second year of the - middle class in Al-Maali Secondary School for Girls divided into two groups each group (41) A student Table (2) illustrates this.

**Table 2: Distribution of Female Students of The Research Sample Before and After Exclusion Among The Three Research Groups**

<table>
<thead>
<tr>
<th>The group</th>
<th>Division</th>
<th>Female students before exclusion</th>
<th>Excluded students</th>
<th>Female students after exclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>a</td>
<td>47</td>
<td>6</td>
<td>41</td>
</tr>
<tr>
<td>Control</td>
<td>b</td>
<td>45</td>
<td>4</td>
<td>41</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>92</td>
<td>10</td>
<td>82</td>
</tr>
</tbody>
</table>

**Control Procedures**

* Internal safety: the variables (chronological age, previous achievement, previous mathematical knowledge test) and table (3a) and (3b) illustrate the results reached by the researchers using the (t-test) and Levin test to see the homogeneity of the two groups in Each variable, as it was found that there is no difference between the two groups in these variables.
Table 3a: Results of (t-Test) with Statistical Description of The Variables Included in The Comparison and The Extent of Homogeneity Using The Levin Test

<table>
<thead>
<tr>
<th>Variable</th>
<th>The group</th>
<th>Number of female students</th>
<th>standard deviation</th>
<th>Arithmetic average</th>
<th>F</th>
<th>Significance level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chronological age</td>
<td>Experimental</td>
<td>41</td>
<td>3.01</td>
<td>148.60</td>
<td>0.20</td>
<td>0.75</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>41</td>
<td>2.99</td>
<td>148.50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Previous achievement</td>
<td>Experimental</td>
<td>41</td>
<td>11.87</td>
<td>62.33</td>
<td>0.11</td>
<td>0.82</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>41</td>
<td>12.03</td>
<td>63.54</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Previous mathematical knowledge test</td>
<td>Experimental</td>
<td>41</td>
<td>4.43</td>
<td>11.22</td>
<td>0.24</td>
<td>0.69</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>41</td>
<td>3.78</td>
<td>12.12</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 3b: Results (t-Test)

<table>
<thead>
<tr>
<th>Variable</th>
<th>The group</th>
<th>Number of female students</th>
<th>Value of t</th>
<th>Significance level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chronological age</td>
<td>Experimental</td>
<td>41</td>
<td>0.87</td>
<td>0.61</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>41</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Previous achievement</td>
<td>Experimental</td>
<td>41</td>
<td>2.7</td>
<td>0.13</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>41</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Previous mathematical knowledge test</td>
<td>Experimental</td>
<td>41</td>
<td>1.01</td>
<td>0.09</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>41</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

External Safety of Experimental Design

* To maintain the integrity of the experiment, the researchers sought to control a number of exotic variables such as (trial conditions and associated accidents, maturity, experimental extinction, confidentiality of the experiment)

Teaching plans: Daily teaching plans have been prepared similar to the general content.

Academic content: Students of both groups were taught the same content.

Duration of the trial: the same time period for the two groups.

Search tool: a standardized search tool was applied for the two groups.

Preparing the Research Requirements

All the requirements of the experiment were prepared from identifying the material, analyzing it, and preparing the two tests.

Research Tool Numbers

Two research tools have been prepared, one of which is an achievement test and the other is a test for the engineering of transfers, the first consists of (40) paragraphs of multiple choice type and the second test consists of (30) paragraphs (20) of which are of multiple choice type and (10) article paragraphs.

1. Validity of the two tests: The validity of the two tests was verified by presenting the paragraphs to a group of arbitrators with a specialization in the methods of teaching mathematics. All paragraphs obtained an agreement rate of more than 85%.

2. Application of the test to the information sample: The two tests were applied separately to a small sample number (26) requesting to calculate the time taken to answer the two tests. The time for the achievement test was (45) minutes and for the transfer engineering test (50) minutes.
3. Statistical Analysis Sample: Two tests were applied to a sample of (100) students, in order to verify the psychometric properties of the two tests. Stability was checked for the two tests, as well as the ease and difficulty of the paragraphs, their discriminatory strength, and the efficacy of the wrong alternatives.

**Statistical Methods**

The researchers used the statistical program (spss) version 22 to statistically treat the data, where a t-test was used, as well as the Levin test to find out the homogeneity between the variables included in the comparison, and the alpha-Kronbach equation to know the stability, the difficulty formula, the differential power and the effectiveness of the alternatives.

**Present and Interpret Results**

Presentation of the results: for the purpose of verifying the two research hypotheses:

1) There is no statistically significant difference at the level of significance (0.05) between the mean scores of female students of the experimental group that were studied according to the proposed strategy and the grades of female students of the control group that were studied according to the usual method of achievement.

2) There is no statistically significant difference at the level of significance (0.05) between the mean scores of female students of the experimental group that were studied according to the proposed strategy and the grades of female students of the control group that were studied according to the usual method of testing remittance engineering. A statistical description was made of the data as in Table 4.

| Table 4: Statistical Description Between The Two Groups in The Achievement Variable |
|---------------------------------|---------|-------------|-------------|----------|----------|
| Group                           | N       | Mean        | Std. Deviation | Std. Error | Mean |
| Experimental                    | 41      | 71.37       | 20.076        | 3.135     |
| Control                         | 41      | 57.32       | 20.371        | 3.181     |

<table>
<thead>
<tr>
<th></th>
<th>F</th>
<th>Sig.</th>
<th>t</th>
<th>df</th>
<th>Sig. (2-tailed)</th>
<th>Mean Difference</th>
<th>Std. Error Difference</th>
<th>95% Confidence Interval of the Difference</th>
</tr>
</thead>
</table>

**Table 5: Results Using (t-Test)**

From Table 5 it turns out that the level of significance of the value of t is (0.002) less than the approved significance level (0.05) and thus rejects the null hypothesis and is replaced by the alternative hypothesis, which states, “There is a statistically significant difference at the level of significance (0.05) between the average grades of students of the group The experimental studies that were studied according to the proposed strategy and the degrees of the students of the control group that were studied according to the usual method of collection and in favor of the experimental group.

The second hypothesis was also tested in the same way and Table 6 shows the statistical description of the variables.

**Table 6: Statistical Description of Variables**

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Std. Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>41</td>
<td>28.54</td>
<td>11.11</td>
<td>1.32</td>
</tr>
<tr>
<td>Control</td>
<td>41</td>
<td>19.12</td>
<td>12.03</td>
<td>1.19</td>
</tr>
</tbody>
</table>
From Table 7 it turns out that the level of significance of the value of $t$ is (0.000) less than the approved significance level (0.05) and thus rejects the null hypothesis and is replaced by the alternative hypothesis, which states "There is a statistically significant difference at the level of significance (0.05) between the average grades of students of the group The experimental studies that were studied according to the proposed strategy and the degrees of the students of the control group that were studied according to the usual method of testing the transfers engineering and for the benefit of the experimental group.

**Conclusion**

In light of the research results, the researchers reached a number of recommendations, including:
1. The strategy built according to brain-based learning has a positive impact on achievement and conversion engineering.
2. The strategy shown, according to brain-based learning, led to female students "interactions between them

**Recommendations and Proposals**

The researchers pointed out at the end of the research a set of recommendations and proposals, and my agencies:
1. Direct the attention of those in the field of curriculum design to the need to include brain-based learning strategies and theories in the curricula of all levels and according to their mental levels.
2. Opening the way for other studies to develop other mathematical skills using brain-based learning strategies.
3. The necessity of providing the necessary educational tools and equipment in the various educational institutions in order to use brain-based learning strategies to achieve a deeper understanding of engineering transfers.

**References**


