

## The Effect of the Pentagon Strategy on Achievement Among Fifth Year Middle School Students in Chemistry

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### Abstract

The current research aims to identify the effect of the Pentagon strategy on achievement among fifth-year middle school students in chemistry. As the experiment began on Sunday (11/29/2020), and ended on Wednesday (2/17/2021), The research sample was randomly selected Which was represented by (Al-Huda Preparatory for Girls) affiliated to the Baghdad Education Directorate / Al-Rusafa II, as the sample size reached (50) students, and the experimental design with partial control was chosen for the two equivalent groups (experimental and control). The experimental number is (25) students taught according to the strategy of the Pentagon, and a control number (25) students are taught according to the usual method. The two research groups were rewarded statistically in some variables (intelligence test, previous achievement, previous information test,). (216) Behavioral objectives for the educational material, which included the first four chapters (first, second, third, fourth) of the fifth-grade chemistry textbook (biological), the research tool, represented by the achievement test, was built. The results were statistically treated and showed: The experimental group students who studied according to the Pentagon strategy outperformed the control group students who studied according to the usual method of achievement test.

**Keywords:** Pentagon Strategy, Achievement, Chemistry

## Chapter One

### The Definition of the Research

#### First: The problem of the research

The science of chemistry is a science with many complex scientific concepts that must always be clarified, appreciated, and understood by female students, and then the possibility of using them in normal life, however, most teachers use traditional methods and methods to teach scientific subjects, especially chemistry, (Abu Zina 2010: 17). However, there is still a reliance on traditional methods of teaching, which led to a decline in the level of female students' achievement in addition to global changes in the wake of the outbreak of the Coronavirus pandemic, which led to a decline in the level of female students' performance.

The results of many studies, such as (Al-Bayati, 2015), (Al-Zuhairi, 2016), (Faleh, 2017) and (Al-Rabaei, 2018). have shown that there is a clear weakness in the academic achievement of fifth-grade students in the subject of chemistry, and those studies attributed the reason for the weakness in the achievement of The fifth scientific students, due to the traditional pattern used in teaching (the usual method) based on memorization and indoctrination. The research problem was identified by answering the following question:

What is the effect of the Pentagon strategy on the achievement of the fifth-year middle school students in the subject of chemistry?

#### Second: The Importance of the Research

The importance of the research can be summarized as follows:

- 1- Using a modern form of teaching that can help overcome some of the student's thinking problems and can be expressed in achieving goals in the field of chemistry teaching.
- 2- This method may contribute to conveying chemical knowledge with less effort and time compared to other teaching methods.
- 3- The lack of studies and research that have used the PG collection strategy.
- 4- The Pentagon PG may contribute to raising the level of achievement in chemistry for the fifth scientific grade (biological), and thus it is considered a contribution to the development of chemistry teaching.

5- The current study is an addition to educational libraries, as it is the nucleus of several kinds of research and subsequent studies that can benefit graduate students and researchers by informing them of the curriculum and its results, preparing its tools, and controlling its variables and results.

### **Third: The Objectives of the Research**

The effect of the Pentagon strategy on achievement among fifth-grade middle school students in chemistry.

This research aims to identify:

### **Fourth: The Hypothesis of the Research**

There is no statistically significant difference at the level of (0.05) between the average achievement scores of the experimental group students who will study according to the Pentagon strategy and the average achievement scores of the control group students who will study according to the usual method for the chemistry achievement test.

### **Fifth: The Limitation of the Research**

During her research, the researcher adhered to the following limits:

- 1- Preparatory schools for morning study in the center of Baghdad governorate affiliated to the Directorate of Education - Rusafa II.
- 2- Students of the fifth grade of science (biology) in Al-Huda Preparatory School for Girls in Baghdad Governorate.
- 3- chemistry textbook for the fifth grade scientific (biological) the first four chapters (first, second, third, fourth).
- 4- The first semester of the academic year (2021-2020) AD.

### **Sixth: The Definition of the Terms**

#### **Pentagram Strategy**

It is defined by (Morsi, & Al-Aziz, 2017). As the plan that is established for a set of procedures that occur regularly and sequentially and aim to solve the pre-prepared problem, so that the individual has awareness and knowledge of his thinking and management processes, plans, takes decisions, implements it, then monitors and evaluates his thoughts, through meditation, self-evaluation, and mental activities. Which are used before, during, and after solving the problem facing him. (Morsi, & Al-Aziz, p. 12, 2017).

#### **Achievement:**

(Ismaili, 2019). defined it as: "A specific level of performance and competence in school work as it is conducted by teachers or through standardized tests or both." (Ismaili, p. 39. 2019).

## **Chapter Two**

### **The theoretical background**

#### **First: Theoretical background**

#### **Pentagram Strategy**

Pentagram is a term made up of two sections: PENTA, which means a pentagon, and GRAM, which means circular design, and it is one of the modern strategies consisting of a set of procedures that occur in an organized and sequential order to solve a pre-prepared problem so that the learner is aware of the operations Thinking, managing and evaluating these processes. This strategy depends on stimulating students' motivation, proposing realistic problems, and preparing and equipping the necessary tools and devices for learners, and organizing individual learners to develop their thinking skills as collective talents to exchange experiences between them and enhance the spirit of cooperation among them as a team so that this strategy works to employ higher levels of thinking. (Ghayad, p. 30, 2018).

#### **The Components of a Pentagon strategy**

The strategy consists of five phases, as follows:

**1- Knowledge phase:** This phase is pivotal for the learner to start achieving the outcomes of the tasks, as it provides the background to the topic of the lesson in a way that stimulates them to search and learn, and aims to provide the general context and general picture of the task that the learners must perform, starting from defining the idea of searching for Information, setting goals by asking the basic questions of the task, and the way the task passes through the use of design.

**2- Planning phase:** During this phase, prior knowledge is organized with the information and data previously collected from the previous phase, to help learners develop a visualization of the steps for the implementation of the mission plan, and determine the steps that must be followed to answer the questions that were previously asked in the knowledge phase. , And fixing methods. Or the means that help him achieve the desired goal of the mission. (Abdulaziz, p. 71, 2016).

**3- Decision-making:** It is the stage in which learners choose the best way to do the task, and choose appropriate alternatives that facilitate their access to the goal, and therefore they must use alternatives and link them to the important central questions

**4- Application phase:** It is the phase of implementing the best designed and selected hypotheses through taking the right decision so that the task is applicable, it is a critical phase for the progress of the task where learners carry out activities to find a solution to this task.

**5- Evaluation phase:** This phase represents the continuous follow-up and evaluation of what the learners do in each of the previous phases, with judging the method and extent of the task progress, and the teacher must encourage the learners and enhance their confidence through moral and material reinforcement to reach the desired results of the task. (Abdulaziz, p. 117, 2014).

**The Advantages of the Pentagram Strategy**

- 1- Developing students' higher thinking skills.
- 2- The development and improvement of the intellectual performance of the students.
- 3- Development of the life skills of students.
- 4- Promote preconceived thinking that reduces costly mistakes.
- 5- It creates an entrepreneurial spirit among students to solve problems.
- 6- Take into account the apparent contrast and individual differences among the students.
- 7- It is compatible with educational technology and modern technologies.
- 8- It works to attract attention and stimulate motivation in pupils.
- 9- It works to transform the traditional learning process into an enjoyable learning process for pupils. (Abdulaziz, p.74, 2016).

**The second axis: previous studies dealing with the strategy of the PG**

Researcher's name, year, and country	Research material	Target	The curriculum used	The stage	the size of the sample	Study tools	Statistical means	Results
Abdulaziz, Amr Syed Saleh 2016 Saudi	Sociology	Identify the effectiveness of a training program based on the Pentagram strategy to develop creative problem-solving skills among gifted students in light of Therese's theory	Quasi-experimental	Junior high	32 Student	Test problem-solving skills in creative ways	Cronbach's Alpha Laboratories, Arithmetic mean, standard deviation, T-test	The experimental group students who studied the use of the Pentagram strategy outperformed the control group students who studied by the usual method.

### Chapter Three

#### The Research methodology and its tools

##### 1- Research Methodology

The researcher followed the experimental method, due to its relevance to the nature of her research and being one of the approaches that use the experiment to reveal the relationships between the two variables, and it is based on the accurate observation of the phenomenon to be studied represented in identifying the effect of the independent variable on the two dependent variables under the scientific experiment, which is a source for reaching accurate results.

##### 2- Research procedures:

##### First: Experimental Design

It means "the plan of the work that the researcher conducts in his experiments, starting with the method of selecting the units of the experiment and distributing them through a specific system and ending with the method of measuring the outcomes and effects of the experiment." (Bin Jajdal, p. 66, 2019). As the current search consists of a variable One independent (Pentagram strategy) and a dependent variable (achievement). Therefore, the researcher adopted an experimental design with partial control for the two experimental and control groups, one of them partially controlling the other and those with the post-test, as shown in the following chart (1):

The two groups	Parity	Independent variable	Dependent variable
Experimental	Previous achievement Intelligence	Pentagram strategy PG	Achievement thinking skills
Control	Previous information Metacognitive thinking skills	The normal way	Metacognitive

Scheme (1) experimental design adopted in the research

##### Second: The research community and its sample

###### A- Research Community

The current research community is represented in all female students of the fifth grade of biology in (Al-Hoda Preparatory for Girls) intentionally chosen from one of the secondary and intermediate schools of the General Directorate of Education of Rusafa II for the academic year (2020-2021, when the research community reached 75) (a student of three classes (A) B, C) and the number (25.25.25) female students respectively.

###### B- Research sample:

It is defined as "a model that includes an aspect or a part of the units of the original community concerned with the research to be representative of it so that it carries its common characteristics. This model or part enriches the researcher in studying all the units and vocabulary of the original community." (Qandalji, p. 186, 2019). As the research sample was chosen in the simple random assignment (lottery), two divisions (A and C) of 50 students and a division (B) was chosen, which represents the experimental group that will be studied on and above the Pentagon strategy, and Division (A) represents the control group that will be studied according to the method The usual method for (25) students for the experimental and control group.

##### Third: The equivalence of the two research groups

Despite the random selection, one of them represents the experimental group and the control group, as well as the homogeneity of the two research groups in the cultural, economic, and social variables because they are a single homogeneous environment that guarantees parity between the two groups, but the researcher decided to control some of the variables that affect the dependent variables to ensure the internal integrity of the experiment (achievement test, IQ test, previous information test

**Fourth: - Controlling extraneous variables**

Extraneous variables are those variables that are not included in the design of the research but affect its results. Controlling extraneous variables is one of the important procedures in experimental research to provide an acceptable degree of internal validity of the experimental design. (Odeh, & Fathi, p. 117, 1987).

**The impact of experimental procedures:**

- 1- Study subject
- 2- Confidentiality of experience
- 3- The teacher of the subject
- 4- Place of the experiment
- 5- Duration of the experiment
- 6- Distribution of classes

**The Experimental conditions and accompanying events**

- Experimental Decay
- Processes related to maturity

**The two measuring tools****Fifth: The Requirements of the Research**

- 1- Determining the scientific material
- 2- Formulating the behavioral objectives
- 3- Preparing the teaching plans

**Sixth: The Research Tool**

To achieve the goal of the research and its null hypothesis represented in measuring the effect of the independent variable on the dependent variable, the researcher was required to prepare a tool for measuring the variable dependent on the research (achievement test). This tool was prepared as follows:

**Achievement Test**

One of the requirements of the current research is to build an achievement test to measure the extent to which the students of the research sample have attained knowledge and to evaluate their progress in the subjects of "chemistry" (under current research) by following:

**Preparing the Test Map**

The specification table is nothing but "a two-dimensional matrix that tries to link the educational objectives in the content elements directly and determines the number of items for each goal related to each element of the content. (Al-Kubaisi, & Rabih, p. 109, 2008). The specifications table was prepared according to the following steps:

**First:** Determining the content weights of the first four chapters of the fifth-grade chemistry textbook (biological) in light of the number of pages for each semester, then extracting the content weight of each chapter of the four chapters. Class content weight = (the number of the pages of the chapter) / (for total number of pages) X 100. The weights of the chapters were (first, second, third, and fourth) respectively (21%, 24%, 34%, 21%) of the total number of pages.

**Second:** Determine the weights of behavioral goals for each level of Bloom's classification of the cognitive domain as follows:

(Relative importance) the weight of goals at the goal level = (the number of the behavioral goals in one level) / (the total number of the behavioral goals) X 100. The relative importance of the four chapters was (21.3%, 23.6%, 22.22%, 19%, 6.9%, 6.9%), respectively, of the total number of behavioral goals.

**Third:** Finding the calculation of the number of questions for each cell in the specification table as follows: Number of paragraphs per cell = Content Weight X Level Weight X Total number of paragraphs (Al-Azzawi, p. 66-68, 2008).

**Building items for the achievement test**

The researcher formulated (40) items based on (the test map) in light of Bloom's cognitive levels, (40) objective paragraphs of the multiple-choice type, with four alternatives, one of which represents the correct answer. This type of test is distinguished by the independence of the measurement results from the subjective judgments of the corrector, i.e. it is not affected by the subjectivity of the corrector and at the same time, it

determines the intended learning outcome and is characterized by the comprehensiveness of the academic subject where the answer to it is specific, fast and short.

**The Formulation of the test instructions include:**

A- The instructions of the answer

B- Test Instructions of the Correction

**The Procedures of applying the experiment:** After the completion of finding the validity and stability of the test and the statistical analysis of its items, the test was ready in its final form for application to the students of the two research groups (experimental and control), the researcher applied the achievement test on the two research groups after completing the teaching of the subject specified in the first four chapters of the chemistry book for the class The fifth (biological science) on the day corresponding to Wednesday (2/17/2021), and the researcher personally corrected the answers of the students of the two research groups and obtained the total score for the achievement test.

**Statistical means:** The results were analyzed and statistically treated using appropriate statistical methods.

**Chapter Four**

**The Presentation and interpretation of the results**

**First: The presentation of the results**

To verify the hypothesis which states (There are no statistically significant differences at the level of (0.05) between the average scores of the students of the experimental group who studied according to the PG strategy and the average scores of the students The control group who studied according to the usual method for the achievement test in chemistry), and after applying the achievement test and correcting the students' answers, the arithmetic mean and variance were found, and the (t-test) equation was applied for two independent samples, and it got the following results, Table (2).

Table (2)( t-Test) for the scores of the two research groups in the achievement test

the group	Number of female students	Arithmetic mean $\bar{X}$	variance $\sigma^2$	The degree of freedom	T-value (t)		The level of statistical significance (0.05)
					Computed	tabular	
Experimental	25	30.52	32.26	48	5.23	2.01	Function
Control	25	23.28	15.54				

From the above table, it becomes clear that the calculated value of (Test- t) (5.23) is greater than the tabular value of (2.01) at the level of (0.05), at the degree of freedom (48), and thus rejects the null hypothesis. That is, there are statistically significant differences in favor of the experimental group in the achievement test, between the average scores of the experimental group students who studied according to the PG strategy and the average scores of the control group who studied in the usual way.

The researcher adopted the eta-squared equation ( $\eta^2$ ) to calculate the effect size of the independent variable (the Pentagram strategy) in its dependent variable (achievement) to ensure that the resulting differences using (t-Test) are real differences due to the research variables or are they due to chance The amount (0.37) appears to be (very large) according to the hierarchy that Cohen's position (Cohen, J.1988) referred to in each of (Murphy, & Myors, 2004). This indicates that the strategy of the PG had a very significant effect in increasing the achievement of the experimental group students of the chemistry course compared to their peers in the control group.

**Second: The Interpretation of the results**

The results showed the superiority of the experimental group that was studied according to the strategy of PG over the control group that was studied according to the usual method of achievement test for the benefit of the experimental group due to:

- 1- Teaching according to the PG strategy is an active cognitive process that provides students with the opportunity to pass through a variety of exploratory educational experiences through which they explore the concept to be learned relying on themselves in extracting and constructing meaning because it is a strategy that emphasizes the importance of practice and action, which increases their understanding and construction of information and this led to an increase in their performance in achievement test.
- 2- Providing students with the spirit of initiative to bring about change and reaching to solve problems through the students' activities in the classroom and their positivity through discussion and dialogue between them has generated a scientific momentum within the classroom, which was reflected in their educational attainment and their performance in the achievement test.

### Conclusions

In light of the results of the current research, the researcher was able to conclude the following: - The results of the research showed a positive effect in the use of the PG strategy, which contributed to raising the scientific achievement of fifth-grade students (biological), with a very large impact size (0.37).

### Recommendations

- 1- Adopting modern strategies in teaching chemistry, especially the PG strategy in teaching chemistry, to encourage students to learn and think, and because of its effect on raising the level of achievement and supra-cognitive thinking among the scientific (biological) fifth-grade students.
- 2- Organizing training courses for chemistry teachers on how to use the PG strategy under the supervision of qualified trainers to teach and train them.
- 3- A testimony of the chemistry teachers for the fifth grade of science (biological) of the teaching plans and the achievement test.
- 4- Activating the role of female students in taking the initiative and advancing the educational reality that has been fading in the recent period, by adopting strategies, models, and methods that give them priority in actual practice and serious dealing with scientific material.

### Proposals

To complete and develop the research, the researcher proposes several proposals as follows:

- 1- Conducting a similar study using the PG strategy for different stages of study, in other study subjects.
- 2- Conducting another study using the PG strategy and its effect on other types of variables (Scientific tendencies, scientific curiosity, innovative thinking, visual thinking, critical thinking, positive thinking, etc.).

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