

The Effect of the Pentagon Strategy on the Achievement of Chemistry among the Second Grade Intermediate Female Students

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Abstract

Study aims to examine the impact of the pentagram on the chemistry achievement of second-year day intermediate students, Al-Sadir School for female was specifically chosen as the student of the research sample related to the Baghdad Al-Karkh Directorate second for the school year 2022-2023, The researcher used the experimental approach the research, where the research sample consisted of 53 female students distributed into two groups, one of which was taken randomly to represent the experimental group, the number of which was 27 female student who studied according to the Pentagon strategy, and the control group had 26 female student They studied in the usual way, After excluding the number of female students who failed, Both of groups were exposed to A collection of factors exemplified by (chronological age, previous achievement in science, and the Raven test for intelligence), The two researchers designed a (40 item test) achievement exam as a study instrument , After applying it to both groups, The results were treated statistically.

Keywords: Effect , Teaching strategy, Pentagon, Chemistry achievement, The Second Grade Intermediate

Introduction

The teacher's role in education is critical to student success, and as a future teacher it is important to understand the relationship between the teacher and modern teaching methods. Effective teaching requires a deep understanding of both the subject matter and the students being taught. This research and enrichment aims to provide future teachers with insights and guidance on how to approach student education in an effective, modern and engaging way, And this is what the study of (Muhammad, 2013) indicated to the emergence of an urgent need to use modern teaching strategies that help individuals in general and students in particular to confront and solve problems that

lead to Creating life problems for the individual himself (Muhammad, 2013: 271).

Research Problem:

The teaching process is currently witnessing tremendous and growing interest from specialists. Specialists aim to improve and develop teaching methods and pay attention to the basic principles and concepts that students learn to become part of their cognitive and mental structure. This helps them to plan, make decisions, implement educational activities, and evaluate them correctly to keep pace with scientific progress in the fields of science in general and chemistry in particular. The researcher has found that the lowest level of academic achievement in chemistry is the most prominent problem students need help with through her experience teaching chemistry for the intermediate stage, specifically the second intermediate grade. The results of the studies have shown that as a study of (Calabi, 2016), (Obaid, 2017), (Ahmed, 2020) and (Sayyad, 2021) There is a clear weakness in the achievement of the second intermediate grade students in chemistry. In addition to the nature of the methods used in the educational process, most chemistry teachers relied on traditional methods that depended on memorization and indoctrination during their teaching practice, ignoring the positive role of the learner, whose results were negatively reflected in their failure. In order to acquire knowledge and not to apply previous skills and experiences in the teaching process, the need to review all elements of the educational system in order to update them in line with scientific development (Aziz et al., 2020: 666 (The two researchers identified several schools affiliated with the General Directorate of Education of Baghdad - Al-Karkh II, whose names are provided, and drafted a questionnaire to investigate the perspectives of female chemistry teachers in this community. All of these teachers have seven years of experience or more teaching the subject. Through their answers and discussions, the following is shown:

1. There is widespread dissatisfaction among female educators; 92% say they are not happy with their students' performance in chemistry by the end of the second year of intermediate.
2. 100% of female teachers do not know the Pentagram strategy, knowing that Since some of them have degrees in education, they are familiar with some active learning strategies.

The researchers concluded that the adoption of the Pentagram strategy may help to improve the level of achievement of female students as a result of the questionnaire results, which added to the existence of deficiencies and low levels of achievement of female students. This study aims to determine the effect of implementing a

contemporary teaching strategy based on active learning (the pentagram strategy) on the performance of female students enrolled in the second intermediate level of chemistry. Based on their findings, (Kadam and Susan, 2021) highlight chemistry's centrality as a foundational science that contributes significantly to the development of nations and societies (Kadam and Susan, 2021: 421).

The question that led the two researchers to their research problem was:

How does the pentagram approach affect Achievement in chemistry for second-year intermediate Female?

First: Importance of the Research:

The importance of the current research stands out from the importance of adopting modern strategies for teaching that have shown their effectiveness in raising the level of achievement and acquiring mental abilities and skills in solving problems, including the Pentagram strategy. "The Deanship of Scientific Research at Umm Al-Qura University - Saudi Arabia" began paying attention to the importance of the Pentagram as a strategy that contributes to developing creativity and problem-solving among students. In 2019, a course was held on the Pentagram Strategy, and a course was implemented (on Pentagram and Research Problems) on (29/10/2019).

An increase in scientific knowledge also characterizes the current period. The rapid cultural changes and the globalization revolution have been reflected in the educational institutions that imposed a new reality for scientific education to keep pace with these changes, in addition to deepening science and teaching it in the stages of public education to contribute to preparing people who can follow scientific thinking and adapt to different life situations. Teaching strategies and methods are an essential component of the curriculum. It is closely related to the objectives and content and significantly impacts the selection of educational activities that should be adopted in teaching (Ahmed and Majed, 2017:499).

Therefore, recent trends in the education sector in general and the teaching of chemistry in particular call for the importance of using modern methods in developing teaching and criticizing the traditional methods used in most schools that focus on the role of the teacher and marginalize the role of the learner (Fatah, 2021: 5). Therefore, this progress necessitated the provision of a rich environment concerned with the development of the learner's personality in a balanced way, so that he can open up to the world (Ahmed, Muhammad, 2022: 570). Therefore, as a result of the rapid development of educational fields, which prompted teachers and specialists to pay attention to teaching

methods and strategies, in line with the development during conferences inside and outside Iraq, which emphasize the reconsideration of school curricula and the use of the most modern methods and strategies during teaching. (Al-Obaidi, Susan: 2020, 187),

The researchers believe that this strategy raises the learner's academic achievement level in the educational process. This is one of the goals of teaching chemistry at all educational levels. The process of reforming education is an important issue. It is the first building block for the reform of society and the life of the individual in particular, as education is a complex phenomenon of factors and interactions of reciprocal impact and influence on the course of the educational process. Education is not a one-dimensional behaviour but an activity that includes more changes that affect the behaviours of the individual learner (Hussein, 2020: 119), Therefore, education is the nation's tool to achieve any desired progress, and it is the way to raise the level of individuals The aim of competent learning is not merely to understand one subject and to be able to retrieve it or to perform some of the procedures contained in it, but rather to include the Expansion of expertise (Abdel-Saheb and Susan, 2014: 114).

Second: The importance of the research can be summarized as follows:

1. This strategy has the potential to expedite the dissemination of chemistry-related knowledge.
2. The PG pentagram is an advancement in the field of chemistry education because it has the potential to improve student performance in the subject at the second intermediate level.
3. It is possible to benefit from the research results, its tools, and its steps for the teachers of the subject to develop their teaching behaviour and organize the classroom environment and academic content.

Third: Aim of the Research:

The purpose of this study is to determine whether or not the pentagram strategy improved the chemistry skills of students in the second intermediate grade.

Fourth: Research hypothesis:

Following is the research's null hypothesis, which was developed to guide the study's findings:

- "There is no statistically significant difference at the level of significance 0.05 between the mean scores of the students of the experimental group who study according to the pentagram strategy and the average scores of the students of the control group who study according to the usual method in the collection of chemistry" .

Fifth: Search limits:

1. The human limit: young ladies studying in Baghdad and the Karkh Governorate for their Intermediate Level Two courses.
2. The spatial limit: one of the public day schools in Baghdad's Middle and High School Sector that is part of the Karkh II District's General Directorate of Education.
3. Time limit: semester one, year two, or the first half of the school year (2022-2023).
4. Knowledge Limit: Content from the second intermediate level science textbook, fourth edition, 2021 AD / 1443 AH, including chapters (Chapter One: Elements and Chemical Bonding) and (Chapter Two: Chemical Compounds).

Sixth: Define terminology:

1- Effect:

(Al-Shawish, 2012) defined it as: “the result of something and the result that is arranged on it.”

(Al-Shuwaish, 90:2012)

2- Strategy:

(Al-Serr et al. 2021): An organized, arranged, and sequential sequence of the teacher's movements within the classroom, a set of guidelines that determine the teacher's path and itinerary within the classroom.

(Al-Sir et al., 2021: 17)

3- Pentagon Strategy:

According to (Abdelaziz and Nevin, 2017), a procedure is a predetermined plan for a series of actions to be taken in a specific order to achieve a desired result. That one be cognizant of, familiar with, and in command of one's own mental and administrative procedures. Ability to plan, make, and carry out decisions is an added bonus. Then, he meditates, examines himself, and engages in other mental activities before, during, and after he attempts to solve the problem at hand in order to keep track of his thoughts and make adjustments as necessary.

(Abdul Aziz and Nevin, 2017: 12)

The two researchers define it procedurally as (a modern, distinctive strategy based on active learning, consisting of five frameworks to implement a set of steps. It is a flexible strategy taught to the second intermediate students that consolidates the scientific material, creates a spirit of initiative, motivates students to be creative in knowledge

management and decision-making, reinforces their answer with a scheme, and then applies it accordingly. Experimental way to gain long-term information in their minds and evaluate their ideas in each step of the five frameworks by the teacher).

4- Achievement:

According to Abu Jado (2009), it is the culmination of the student's education after a given time frame. The success of the teacher's method and plans for goals can be gauged by the grade he receives on the standardised test administered to assess learning outcomes.

(Abujadu, 2009: 425).

5- Second Grade Intermediate:

- The middle stage is defined in the secondary education system in Iraq as "one of the two stages that make up the three-year average school in which the holder of a primary certificate or its equivalent is accepted, with the aim of achieving scientific, professional, social and national competence; to prepare students for a productive social life and for continuing education."

(Ministry of Education, 1985: 403)

From a methodological standpoint, this is what the research sample of students ends up with when the study is over in terms of chemistry knowledge and ability, as defined by the two researchers. It is evaluated based on how well students in the intermediate-level second year performed on an academic test developed by the two researchers.

Introduction of Pentagram strategy:

Developing the learners' cognitive abilities by the teaching staff has become a strategic goal in all developing countries. It helps learners to adapt efficiently and effectively to the development of knowledge and changes in the modern world. The world is based on the cognitive mental abilities that the learner possesses to realize and understand the relationships between things and events to confront and solve problems, issues judgments and evaluate life situations. From this point of view, it is necessary to search for modern strategies that develop thinking and address the mental abilities of the learner and bring the educational curricula closer to the reality or the environment to which the learners belong and rely on modern trends in teaching on active learning. The Pentagram Strategy is among the modern strategies that develop capabilities, thinking and problem-solving. (Khalil, 249: 2020)

Franklin J. Hildy and Nicholas Ovenshouse mentioned that the idea of the pentagram strategy, "the five-pointed star map," had been found

among mathematicians for a long time. Nevertheless, it was crystallized and began to be used effectively in the field of modern teaching in 1992 by Richard Evan Schwartz, taking the form Pentagon, home of the US Department of Defense, a form of the Pentagon in the field of mathematics, and applied this strategy to the geometry of polygons in the projective plane; In the sense that the original strategy was mathematical engineering in the first place, and it was not applied in the field of science or social studies (Ovenhouse, 2019:9).

Both (Plavskyy & Glick 2016) emphasized the importance of the pentagram strategy stemming from being a specific dynamic system that starts from simple construction to a semi-complex knowledge structure that depends on the integration between its components (Plavskyy & Glick, 2016).

Better yet, Dolk Daniel and Janusz Granat point out: Then, thanks to the work of people like Nakamori and Wierzbick, the Pentagon method was established as an attempt to bring together the rational, mechanical, and technological parts of knowledge. Knowledge and its use in two contexts: a long-term philosophical and social one. The Pentagon and its application represent a five-fold system of knowledge that incorporates the scientific dimension (represented by "intelligence"), the social dimension (represented by "involvement"), and the imaginative dimension (represented by "imagination") (the dimension). innovative), Intervention (after the problem has been applied), and integration (the cognitive component); It is an elaborated effort that blends (Western scientific empiricism) with (Eastern dialectical theory), and which creatively merges systems engineering and knowledge management (Dolk.D & Granat, J., 2012:12).

They are supported by Kato Tsuyoshi's view that the Pentagon arose from what is called classical geometry, which is based on the following:

- The rational dynamics of facts.
- Analytical Relationships.
- Making decisions.
- Introduction to Systems (Tsuyoshi, 2016: 3).

Pentagram strategy

The word "pentagram" consists of the two parts "penta," meaning "five," and "gramme," meaning "design," therefore the word's etymological roots in the Greek language. One of today's methods, it involves a series of steps taken in a predetermined order to answer a problem, with the goal of helping the student become self-aware and in control of his own thought processes through the evaluation of his

solutions. This approach is predicated on arousing students' interest, providing challenges that are relevant to their lives, and supplying students with the resources they'll need to solve those difficulties. It sets up students to share knowledge and grow as individuals while also fostering a team mentality of cooperation and sharing. Methods of a more complex nature are used in this approach (Ghayad and Ahmed, 2018: 29-30).

The importance of using the Pentagon strategy is also because it links behaviour, task and use. To search for answers revolving around questions that start with what? It is determined in the light of the function of knowledge. And how? Moreover, is defined logically in light of the link between the different elements, and why? Through it, evidence of persuasion is determined, and in light of it, universities' identities and cultures are determined (Al-Omari and Asim, 2022, p. 223).

In addition, he (Younes,2022) described it as one of the modern teaching strategies based on active learning, consisting of five frameworks to implement a set of procedures. It gives students of the second intermediate grade enough space to innovate in managing knowledge, making decisions about it, and evaluating their thinking in each step of these five frameworks (Younes, 2022: 347).

The importance of the pentagram strategy in the educational process:

1. It helps to avoid distracting students and wasting their time.
2. Encouraging students to deal with different sources of knowledge.
3. Helping students acquire research, learning and thinking skills.
4. Investing in all available capabilities and modern technologies for e-learning and facilitating the learning process.
5. It allows students to research specific points deeply and thoughtfully from various sources

(Abdul Aziz, 2016: 72).

Procedural steps for applying the Pentagon strategy

The procedural steps for implementing the strategy are presented as follows:

A- (View the task):

The learners are asked to carry out a specific task, which can be a question.

B- (solving the task):

Where the learners are required to ask questions about the strategy and follow the phases of the strategy to carry out the educational task as follows:

1. Knowledge: Searching for information and data using various sources, such as the Internet, libraries, research, previous studies, and other reliable multiple sources, and accessing the desired information.
2. Planning: Developing an action plan to implement the educational task, i.e. making a comparison table or concept maps and putting all the information collected in the previous stage or phase.
3. Decision making: Is the information collected in the comparison table sufficient and fulfilling all aspects of comparison that have been developed, or is it incomplete? We must return to the previous knowledge stage and collect more information and data to complete the task of this stage.
4. Application: Developing the final form of the comparison table and fulfilling all aspects of comparison with it or applying an experiment from the materials available from the environment to acquire new knowledge and retain it in the learners' minds.
5. Evaluation: Showing the final comparison table to the group and the teacher to correct it and discover errors to amend them, if any, or ask a question that establishes the task and measures through them the extent of their acquisition and understanding of the scientific material.

C - (View results):

The teacher asks the learners to present their findings during the five phases to the other groups.

D - (Results Evaluation):

Learners assign tasks to each other.

E - (duties and assignments)

The teacher assigns the students a homework assignment that is solved using the Pentagram strategy to develop their problem-solving ability

(Abdel Aziz and Morsi, 2017: 26-27).

- The following figure shows the steps (the five phases) of the Pentagram strategy:

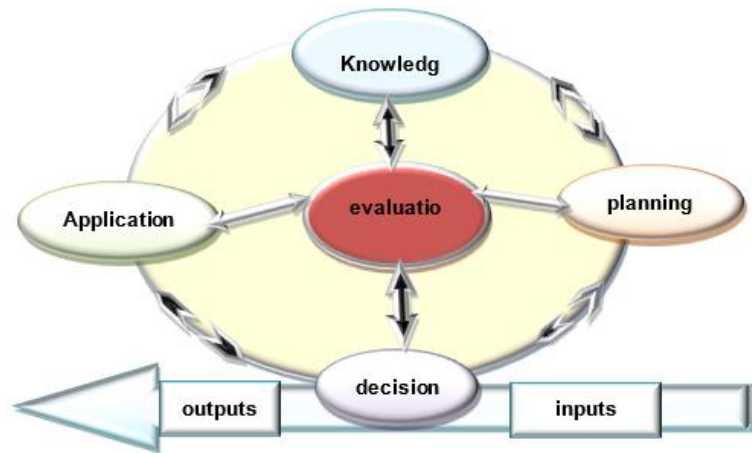


Figure (1) The phases of the pentagram

Achievement:

Achievement is one of the basic criteria for revealing the information and knowledge that students have acquired, and it is important for bringing about a behavioral and social change for students known as learning. The more effective the achievement is for the students, the more positive and educationally important it is in the behavior of the students for the better and helps them to interact with their environment (Al-Khafaf, 2011: 268).

And (Razouki and Daoud, 2017) mention that academic achievement is “a set of skills and knowledge that a student can possess after being exposed to educational experience in a particular subject or group of subjects, and it represents a measurement of the learner’s ability to absorb the prescribed study materials and their ability to apply them through measurement methods.” (the test) (Razouki and Daoud, 99:2017).

Previous studies dealing with the Pentagram (PG) strategy:

Results	Statistical means	study tool	curriculum	sample size, sex, and stage	class	Study Title	Researcher name, year, country
The female students of the experimental group who studied according to the PG strategy compared to the female control students who studied according to the usual method in testing supra-cognitive .thinking skills	Cooper coefficient Variance equation T-test for two previous independent samples Equation of ease and difficulty Discrimination power equation Equation of effectiveness of alternatives -Richardson-20 Effect size equation	Achievement test and supra-cognitive thinking skills test	experimental	50 female students, Fifth junior high	chemistry	The effect of the pentagram strategy on the achievement of fifth grade middle school students in chemistry	Fattah, 2021, Iraq

(Fattah, 2021)

1-Objectives: The study (Fatah, 2021) aimed to identify the impact of the five-year strategy on achievement and metacognitive thinking skills of fifth grade students in intermediate chemistry.that Similar in the independent variable which is the achievement but different levels of study.

2-Research Methodology: The current study agrees with the study of (Fattah, 2021) in its use of the experimental method.

3- Sample size and gender: The current study agreed with the study of (Fattah, 2021) in the gender of the sample, which is females, and differed in the size of the sample, as the study of (Fattah) 50 students, while the current study 53 students.

4- Results: The previous study found a statistically significant difference in favor of the experimental group. As for this study, the researcher will present its results in the fourth chapter, God willing.

Research methodology and procedure

Research Mythology:

The ultimate goal of experimental study is to obtain the most precise results possible. This information is lacking from comparable studies (Al-Kilani and Al-Sharifi, 2005: 31). This led the two scientists to settle on an experimental method.

Experimental Design

The term "experimental design" is used to refer to the researcher's strategy for carrying out an experiment, from the selection and distribution of experimental units via a given system through the analysis of the results (Bin Jakhdal, 2019: 66).

To show how the pentagram method affected the dependent variable, the two researchers used a somewhat controlled experiment (achievement). Both groups will take the accomplishment test, and the disparity in their scores will be determined at the conclusion. The research's experimental design is laid out in the Schedule(1) below:

Schedule (1)

Post-test	dependent variable	the independent variable	parity	Two groups
Achievement test for chemistry	achievement-	Pentagram strategy (PG)	Chronological age in months Previous collection	experimental
		the usual way	Intelligence (Raven) previous information -	control

Research experimental design

Preparation of the two researchers

"Determine the research community and its sample" :

Research Population: It is a snapshot of the population being studied right now. These girls are now enrolled in grade two at one of the public intermediate or secondary schools in Baghdad or Karkh that is part of the General Directorate of Education (2022-2023). According to the book published by the College of Education for Pure and Applied Sciences - Ibn Al-Haytham, the number of intermediate and secondary schools as well as the number of female students were obtained by the researcher from the Planning Division, the Statistics Division of the General Directorate of Education of Baghdad, and the second Karkh.

Sample Research: Second-year female students at Al-Sudair for Girls, a middle school associated with the General Directorate of Education in Al-Karkh, provided the research sample (2022-2023). This is the major experiment's intended target. The researcher got a book from the General Directorate of Education of Baghdad / Al-Karkh II to aid in the undertaking, and then randomly selected two divisions out of six (Al-Sudair Intermediate School for Girls). By random appointment, it was found that the number of students in the second intermediate grade in this school is (268) students. The research groups were chosen by random drawing (lottery). Group (B) consisted of (48) test subjects who were subjected to instruction based on the (Pentagram approach). (42) pupils make up Division (A), who are being taught in the standard fashion. Three-thirty-three of the female students who had the worst failure rates throughout the previous academic year were left out. Female students who gained a year of age (4) were excluded to preserve the experiment's integrity and ensure equivalence. Having different experiences or lack thereof may affect them differently from their peers. Therefore, the sample members reached (53) students after exclusion. As it became class (a) includes (26) students, and class (b) includes (48) students. Schedule (2) illustrates this.

Schedule (2)

Reason behind exclusion	Number of students			division	group
	The number of students in the final sample	exclusions	before exclusion		
19students failed in the last year and 2 gained a year.	27	21	48	B	experimental
14 students failed in the last year and 2 gained a year.	26	16	42	A	control

Distribution of the research sample students between the two groups (experimental and control)

Control Procedure

A- Internal validity For experimental design.

1- Equivalence of the two search groups

The number of variables equalized the two research groups:

Schedule (3)

	T-Value		difference	mean	group	variable
	Tabular	nepotism				
is not statistically significant	2	0.474	11.655	159.259	experimental	Chronological age in months
			12.397	158.807	control	
is not statistically significant	2	0.405	212.897	74.925	experimental	Science achievement test
			319.193	73.115	control	
is not statistically significant	2	0.483	41.847	36.629	experimental	Raven's intelligence test
			34.798	35.807	control	
is not statistically significant	2	0.720	2.768	10.666	experimental	Test previous information

2-"Duration of application of the experiment The duration of the experiment was equal for both research groups experimental and control" . Teaching began on Tuesday, 10-18-2022, and ended on Sunday, 1-15-2023.

3-Experimental extinction (experimental wastage): Except for the simple and equal occurrence of absent individuals across both groups, neither of the research groups experienced any dropouts, interruptions in work, or transfers of female students between departments during the experimental period.

4-Processes related to maturity: The students in both groups are roughly the same age, thus there are no discernible disparities in the maturity level between them. Both groups' similarity in size and composition provided evidence of this. The other factor is that the experiment was conducted simultaneously on both groups. Thus, the age group studied makes no difference to the findings.

B_ Checking the external integrity of the experimental design:

1- The confluence of the experimental factor with the selection procedure: In order to mitigate this result, the six participants were randomly split into two groups for the study..

2- Interaction of experimental situations: The two scientists were eager to conduct lessons for both groups under controlled laboratory conditions. The only tactic other from the pentagram strategy that the control group was unaware of was the experimental one.

3. The effect of the experimental procedures: As the two researchers began their work at the beginning of the school day, no noticeable effect occurred. As this was during the first semester, none of the students had any prior exposure to a chemistry institution.

Search tool:

The researchers developed a test to compare the performance of the test group with that of the control group. Due to this, the two scientists built the achievement test using the following procedures:

-Determining the aim of the test: The purpose of the chemistry test is to assess the learning gains made by the research sample (2nd-year intermediate school students) as a result of participating in the experiment, and thus to illustrate the impact of the independent variable on the experimental group.

-Determining the scientific material: The following chapters were found in the 2021 AD / 1443 AH version of the second intermediate science textbook: (Chapter One: Elements and Chemical Bonding) and (Chapter Two: Chemical Compounds).

-Formulation of behavioural objectives: According to Bloom's classification, the two researchers formulated (163) behavioural objectives and presented them to a group of teaching methods and evaluation measurement experts.

-Preparing a table of specifications (test map): The two researchers prepared a Schedule(4) of specifications that includes all of the following:

Schedule (4)

total	aims						weight	No. of classes	Chapter	Study units
	%2	%2 installa tion	analy sis %4	%12 applica tion	compreh ension %39	remem ber %42				
23	0	0	1	3	9	10	%58	7	First	Unit 1

17	0	0	1	2	7	7	%42	5	second	
40	0	0	2	5	16	17	%100	12	total	

Drafting test instructions: These include the following:

Answering the achievement test items: The two researchers set some instructions that must be taken into account before answering, explaining to the student how to answer the objective and essay items of the test.

Correction instructions: The two researchers gave the achievement test in its final form, consisting of (40) items. Including (38) objective paragraphs, the score of each paragraph is (0-1), and (2) essay paragraphs, the score of each paragraph is (0-6). Thus, the highest score for the achievement test is (50), and the lowest score for the test is (0).

"Validity of the test: The validity of the test was verified using"

Virtual honesty: A panel of experts in the fields of pure chemistry, chemistry education, measurement, and psychology reviewed the achievement exam I developed and provided feedback on its content validity, language accuracy, and structural soundness. After distributing and collecting the questionnaires from the arbitrators, the researcher found that the percentage of agreement on each paragraph exceeded 80%. Based on the Cooper equation, she considered that 80% achieved the apparent validity of the achievement test.

Validity of the content: The preparation of the table of specifications prepared by the researcher, table (1), achieves this kind of validity, and in light of that, the test has become ready in its final form.

The Achievement Test Pilot Study: The Pilot Study Consists of Two Parts:

The first stage: is the first exploratory application: if the researcher applies the test to (50) female students from the second intermediate grade from the same school in which the research is conducted. However, in another division that is not part of the two research groups (Division D) on 5-1-2023 on Wednesday. After verifying with the chemistry teacher that she had covered all the material that would be covered in the first two chapters of the Science Book, fourth edition, year 2021 AD, she proceeded to teach the material. The researcher oversaw the application used to administer the tests herself, monitoring the clock as it determined how much time was needed to complete each question. It ranged between (35-45)

minutes, and the arithmetic average of the time taken for students to answer reached (40) minutes.

The second stage: is the second exploratory application: to ascertain the psychometric characteristics of the achievement test. The test was applied to an exploratory sample in Al-Muddathir Intermediate School on 6-1-2023, corresponding to Thursday, after ensuring that the chemistry school had completed the curriculum for 2022-2023. The researcher applied the test alone and in cooperation with middle school teachers.

- Statistical analysis of the achievement test items: it includes both of the following:

Paragraphs difficulty coefficient: The two researchers observed that the difficulty of the substantive paragraphs was calculated by adding the percentage of incorrect responses to the paragraph's difficulty coefficient. Observations showed a spread from (0.448-0.573). Each essay paragraph's accuracy was determined using the aforementioned equation, yielding values between (0.551-0.523). For both thematic and essay paragraphs, this difficulty scale is satisfactory. You may judge a paragraph's quality by its difficulty coefficient, which should be between 0.20 and 0.80. (Melhem, 2012: 269).

Items Discrimination Coefficient: Test items designed to measure objective aspects of academic performance have their discrimination coefficient determined. The price for it varied between (0.588-0.867). As for the article paragraphs, the discrimination coefficient was calculated through the discrimination equation, ranging between (0.441-0.526).

Efficacy of False Alternatives: The two researchers applied the equation of the effectiveness of False Alternatives to the multiple-choice thematic paragraphs. As all the numbers are negative, it seems that the lower-performing students were more likely to choose these options than the higher-performing ones. Because of this, we may say that the choices are satisfactory, and that the values fell inside the (-0.088 - -0.411).

Eighth: statistical methods

The t-test for two independent, unequal samples.

The alpha-Cronbach equation

- Equating the difficulty of the paragraphs

- Equation of distinguishing the substantive paragraphs

Equating the difficulty of the essay paragraphs

Equation of highlighting essay paragraphs

Equating the effectiveness of false alternatives

- Cooper's equation

One-way analysis of variance

- ETA box

Presentation and interpretation of results:

A- Presentation of the results: "The null hypothesis was rejected and replaced with the alternative hypothesis after finding a statistically significant difference at the significance level 0.05 in favour of the experimental group" .Results related to the effect of the pentagram strategy and chemistry achievement.

Schedule (5)

effect size	0.05 Statistical significance at the level	T-value		Degree of freedom	standard deviation	mean	Number of students	group	n.
		Tabular	nepotism						
big	function	2	18.123	51	4.316	42.592	27	experimental	1
					2.465	25.000	26	control	2

B- Interpretation of the results: The results in schedule (5) showed that the students of the experimental group who studied chemistry according to the Pentagram strategy excelled over the students of the experimental group who studied chemistry in the usual way in the achievement test in favour of the experimental group, and this is due to the following reasons:

1-Pentagram strategy (PG): It is one of the modern active learning strategies in teaching. Therefore, it contributed to helping students organize and set their goals, which led to an increase in their ability to remember and organize information.

2- The strategy of the Pentagram helps to attract the attention of the experimental group of students to the practical content in an innovative way. This is done by presenting the questions on the Date Shaw board and then presenting the models. This is not applied in the usual teaching methods.

3- The Pentagram approach (PG) views education as an active cognitive process in which students engage in a number of different learning scenarios in which they learn by doing and rely on their own

abilities to extract and construct meaning from the material presented. They did better on the accomplishment test since this is one of the methods that stresses the significance of hard work and repetition in learning new material.

4_ The experimental group students present various and different ideas within a short time after asking the questions about the task entrusted to them and inquiries by the subject teacher, which distinguishes them from the students of the control group.

5- Teaching according to the Pentagonagram (PG) strategy provided the students with the opportunity to produce many solutions to the problem by adopting multiple sources of information through the Internet or other sources. This increases their understanding of the information they have studied. This led to a higher level of students' knowledge and increased performance on the achievement test.

Conclusions: From their findings, the two researchers drew the following conclusions:

1- The current study's findings demonstrated that the Pentagonagram (PG) approach increased student achievement in secondary school by an impact size of (0.846).

2- Teaching the students of the second intermediate grade according to the Pentagonagram strategy is fun. Furthermore, it is in the form of cooperative groups, which stimulates the carrying out of activities that allow students to participate in order to accomplish the tasks assigned to them, not to find logical solutions to the problems presented, and to provide a scientific explanation for the phenomena. This makes one student able to impose hypotheses, and all of this, in turn, contributes to understanding the scientific concepts of chemistry and correcting misconceptions in the structure of scientific knowledge.

Recommendations: In the light of the results reached by the two researchers, they made recommendations as follows:

1- The Pentagonagram (PG) strategy in teaching chemistry is highlighted as an example of a cutting-edge approach that should be adopted in order to motivate students to learn and develop their cognitive mental processes and to increase achievement among intermediate school students in grades two through four.

2- Chemistry teachers and teachers should be informed about modern methods and methods of teaching by holding educational courses, seminars and conferences and inviting male and female teachers to them.

3- Conducting workshops for educators on the Pentagon (PG) approach for teaching chemistry. They are being taught and trained by professionals under their watchful eyes.

4- Providing an appropriate classroom environment encourages the learner to innovate and activate the role of the learner by exercising their mental abilities in learning and expressing their opinions with absolute freedom.

5- To improve the state of education, which has been deteriorating in recent years, we must adopt strategies, models, and methodologies that place a premium on their use in the real world and their meaningful engagement with scientific content.

Suggestions: As a complement to the research, the two researchers suggested the following:

1- Conducting other studies to find out the effect of the pentagon strategy on other variables such as "smart thinking, scientific inclinations, scientific culture, scientific thinking, habits of mind, visual intelligence, fluid intelligence, and others" .

2- understanding the effects of different tactics on performance and conducting a comparison between the Pentagon and other techniques.

3- Conduct a comparative study between females and males to determine the effect of the pentagon strategy on each of them for the second intermediate grade.

4- Using the Pentagon (PG) method to conduct research along similar lines for a variety of academic disciplines and student populations.

Conclusion:

The use of modern teaching methods in teaching, especially such as the Pentagon strategy, is a vital and humane process that works to deepen the scientific material in the minds of the learners, And the study of (Muhammad,2018) added Education is a human process aimed at helping students at all educational levels to accept forms of knowledge and science to achieve integrated development of their personality to develop all aspects of their growth, including physical and mental. The potential of teachers plays a significant role in achieving this by creating a sound educational environment and teaching methods that establish the learner's self-confidence (Muhammad, 2018: 189), And confirmed (Abdullah, 2017) that human is a learning being, so the basic message of the curricula of educational institutions becomes facilitating learning for the learner (Abdullah, 2017: 324).

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