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

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Abstract

The research aims to find out the impact of the SPAWN strategy on the achievement of chemistry for the students of the second intermediate grade in Al-Razi Intermediate School for Boys. Two divisions of the second intermediate grade were chosen randomly, with a sample of (66) students. The research tool was built, which is the achievement test of (40) objective items. After applying it to the two research groups and analyzing the results statistically, the results indicated that the students of the experimental group outperformed the students of the control group in the achievement test. Based on the results extracted. The researcher recommended using the SPAWN strategy in teaching chemistry and put forward a number of proposals.

Keywords: Teaching Strategy, Spawn, Chemistry Achievement, Second Grade Intermediate Students, Effect.

Introduction

Science is a human construct, and when we want to teach it, we must take care of three things about its reality such as knowledge, skills, and attitudes. The new knowledge can work to arouse the curiosity of the learners and push them to search and investigate, and it can stimulate the experiences of the learners to develop new ways to solve problems. Skills can be used to build new knowledge. The main goal of science is to provide students with experiences that will help them become scientifically educated(Al-Huwaidi, 2008). Science, as mentioned (Saidi, 2019), is considered one of the factors for the rise of societies on the ladder of advancement and development. Therefore, interest in the methods and strategies that focused on teaching science appeared so that future generations possess the basics of science and knowledge, its tools, and how to use it(Mohammed, 1981). Chemistry is an important vital science, as it is

directly related to life, so life cannot continue if the chemical reactions stop inside his body, and it is not possible to reach the manufacture of new medicines, agricultural pesticides, or industrial materials without the help of chemistry. This development related to the science of chemistry has placed the responsibility on specialists in the field of education to develop new plans for teaching chemistry so that it can keep pace with the progress achieved(Abdel-Amir, 2016). Productive teaching is the one that looks at the mind as having a great ability to learn(Joyce & Weil, 2011) and for this it was necessary to use teaching methods that provide active learning, and make the student alert, positive, and active inside and outside the classroom(Al-Busais, 2011). Modern strategies work to integrate the student into the educational situation and give students the opportunity to talk about themselves and provide them with activities in the form of games, competitions, questions, physical movements, activities, teacher enthusiasm and friendly debates (Saidi, 2019). As for the usual teaching methods used in our educational institutions, the student feels lethargic, and this leads to a decrease in the educational attainment of students (Aziz, Suzanne, & Al-Bawi, 2020). This was confirmed by a number of studies in this field (Mahmoud, 2020); Muhammad and Jalil (2020) which demonstrated the importance of using modern teaching strategies in teaching chemistry and its impact on increasing the academic achievement of second-grade intermediate students in chemistry.

In this context, and with the increasing need for attention to the use of active learning methods and effective educational methods, Spawn strategy, as seen by Christensen (2000), is one of the strategies that show the strength of the student in writing his opinions. It also provides reinforcement and praise for courage, activity and participation in his opinions in front of his classmates. It is possible to expand the participation outside the text or integrate one of the concepts contained in the text with what the student has experienced in his. This participation by the student in writing about his life opens the door for the rest of the students to participate with stories from their lives that enrich the subject matter. It also creates an interaction between the subject and real participations from real people. Interaction with the lesson occurs. This method leads to the participation of all students, even those who hesitate, through the paper that reaches everyone to write their opinions(Christensen, 2000). SPAWN style is a reading style in any field and any content. It is interesting and works to expand the scope of learning, and teachers using this strategy can provide the opportunity to engage students in critical and creative thinking in an orderly manner. It also promotes SPAWN retention of content goals because the more students use the information they have learned, the more likely they are to remember. If students use the insights they learned at SPAWN to examine texts

more critically, they will have more creative options for solving problems. This brings the long-term benefit of SPAWN strategy(Seidel, Kett, & Perencevich, 2007).

Research Problem:

 Through the experience of researchers in the field of teaching chemistry to the secondary level, they found that the most important problem that students suffer from is the low level of educational attainment in chemistry, and the use of traditional teaching methods by chemistry teachers that depend on memorization. Thus, they ignore the positive role of the learner and neglect the development of creativity and intellectual abilities of the student, and thus these reasons constitute a decrease in academic achievement. Al-Bahadli (2019); Mughir, Al-Masoudi, and Khudair (2018) confirmed that there is a weakness in the achievement levels of students in chemistry and their reliance on memorization. Therefore, the researchers believe that some problems can be addressed in the educational process in the field of teaching chemistry by adopting one of the modern teaching strategies that is based on active and cooperative learning, including SPAWN strategy and knowing its impact on the level of achievement among students. In light of this, the research question was formulated as follows:

What is the effect of SPAWN strategy on the achievement of chemistry for second grade intermediate students?

Research Objective: The research aims to identify the effect of SPAWN strategy on the achievement of chemistry among middle second graders.

Research Hypothesis:

There is no statistically significant difference at the level of (0.05) between the average scores of the experimental group students who study according to the spawn strategy, and the average scores of the control group students who study according to the usual method of obtaining chemistry.

The research limits:

1-Human limit: The study is on the students of the second middle grade in all government day secondary schools affiliated with the Directorate of Diwaniyah Education/Center.

2- Spatial limit: One of the government day schools affiliated with the Diwaniyah Education Directorate/Center was chosen.

3-Time limit: It is the first semester of the academic year (2022-2023).

4- Cognitive limit: The first and second chapters of the science book for the second intermediate grade for the year (2021), the second edition were chosen.

Identifying Terminology

1- Effect : "The ability to achieve the intended goals, and reach the desired results, and this term is used in the areas of educational learning, methods, methods, strategies and models of teaching"(Sabri, 2002, p. 410).

 2- SPAWN strategy: It is a strategy that begins after reading the required text of a specific topic, and allows students to actively participate in using their previous knowledge to form creative ideas and new opinions when they answer the demands of the motivating phrases. It depends on the function and use of each of the motivating phrases contained in the SPAWN(Seidel et al., 2007).

Operational definition of SPAWN strategy: The Operational definition: The researcher defines it as one of the strategies of a modern nature, which carries in its aspects the factors of effectiveness and activity, and its role appears in increasing the interaction of students with the class, through the adoption of a number of motivating and enthusiastic statements that challenge the minds of students. It consists of flexible steps (absolute powers, problem solving, multiple perspectives and what if? and the following) and is adopted by the researchers according to the nature of the lesson. This is after it is formulated in the form of questions from the content of the course and answered by students individually or cooperatively.

3- Achievement: That: The level of achievement reached by the learner in school work and measured by tests or teacher ratings. " (chaplin, 1971, p. 5).

Operational definition of achievement: It is the degree that students get in the achievement test submitted to them after they acquire a set of knowledge and information in the book of science – chemistry. The test consists of items representing the topics they studied and according to the importance of each topic and its weight.

Theoretical background

SPAWN   Strategy:

Reading is the key through which anyone enters the various fields of science, and it helps the individual to adapt psychologically. It satisfies psychological needs such as the need to communicate with others and shares their thoughts and feelings. Writing is also of great importance in the life of the learner, as it is his means of expressing his idea and

feelings, and it is an essential component of the functional integrative knowledge of reading and writing in the contemporary system. Writing raises and develops the student's mental abilities, and gives students room to think and reflect(Al-Busais, 2011).

This strategy uses SPAWN to teach science effectively and fun. It focuses and encourages students to write from their daily lives and integrates them into the subject of the lesson after they read a specific text of the subject. SPAWN is an abbreviation for five categories of requests or orders that nominate or secrete smart answers and new ideas, which students write about a specific topic and a specific problem that is posed to them from a specific text that is read to them in the classroom and everyone participates in reading and then records their answers. The phrases are S: absolute powers – P: solving a problem – A: multiple point of view – W: what if – N : Next. These phrases that serve as candidates for innovative new ideas, They are used to motivate students to think purposefully about the subject in question in the lesson. As mentioned (Fisher, 2009)and these writings are usually kept short in the notebooks of students(Brozo, 2017). The SPAWN strategy distinguishes that it is one of the means that enhances the written activity associated with the daily events of the student. It enhances the ability to write stories and events and link them with the subject of the lesson. Writing activity is an important learning method that the teacher must use if he wants to develop the presentation and formation of opinions among his students in the subject(Fisher, 2009).

SPAWN can be used in any other discipline especially science and chemistry, and contributes to motivating students to think creatively. The teacher first prepares the questions according to the spawn statements. When they are completed, the teacher allows students to benefit from their previous knowledge, and they can also develop and compose the questions. It is then possible to move on to the far-reaching advantage of the spawn strategy when students apply spawn templates or phrases on their own(Seidel et al., 2007).

The writings of spoon urge students to combine great and exciting ideas with information related to the subject. This information is derived from the reading of the subject and from the observations and opinions of students. The teacher can use spawn writing for any subject, because the phrases are designed to suit the learning and study objectives of any subject, especially in the science curriculum. Students watch the stimulating phrases on the board, and are asked to write their answers according to the type of stimulating phrase they specify according to the timing given to them, taking into account other activities that take place in the classroom(Brozo, 2017).

Spawn strategy steps:

1-The teacher begins by identifying the tasks that he wants students to acquire, so if they have to deduce or predict what will be provided later of the content. There will be prompt or stimulating phrases that help to apply these tasks and achieve the purpose more than others.

2- If the goal is to develop the skill of criticism among students, the motivating phrase for this goal is the alternative viewpoints that meet the goal. If the teacher's goal is to think ahead about an issue and brainstorm possible solutions to it, then the next is problem solving prompts can be the best.

3- The teacher provides the stimulating phrases to the students, and this is either by writing them on the blackboard or displaying them from the projector overhead or through the computer. If the stimulus statement is predictive, they will need to see the prompt and start typing before the new reading material can be presented to them. If the induction statement is the type that requires deep thinking, it is advisable that the teacher announce it after teaching the new reading material.

4- The teacher gives the students enough time to write their responses. In many cases, the teacher must design statements in a way that allows them to respond in writing within ten minutes. The teacher asks them to write the stimulating phrase on their notebooks and record the history before starting to write their responses.

5-The teacher grades the answers written by the students, to encourage them and increase their ability to read in depth in the topics they learn(Fisher, 2009).

Achievement

Achievement is one of the sources of motivation among students, and some see it as a personal trait, that is, its source is internal, which is an important need in the life of the human being. Individuals have the motivation to achieve and achieve success in tasks in order to obtain reinforcement and reward. Others believe that the Achievement is external because of social factors, the influence of the family and the promotion and encouragement it provides. McClelland believes that it comes from internal control, i.e. internal reinforcement, as they are characterized by perseverance regardless of external rewards or reinforcements. Others believe that the motivation to collect comes from avoiding failure(Zaghloul, 2012).

Achievement reflects the outputs of education and the extent to which it achieves educational goals, hence its importance(Al-Salkhi, 2013). Identifying the level of academic achievement reached by students is like monitoring the educational process by knowing how much

improvement or delay in academic achievement occurs to them. It shows the teacher who prepared his students to learn the subject he teaches, as well as diagnosing the learning difficulties of his students , which leads to the teacher's modification of his teaching method(Murad & Suleiman, 2002).

Previous studies dealing with SPAWN strategy:

Al Kathiri Study 2020: As in Table (1):

Table (1) Al Kathiri Study 2020

Researcher name, year, country	Study Title	Subject	sample size, sex, and stage	study tool	Statistical means	results
Alkthery 2020 Saudi ARABIA	The Effect of SPAWN Strategy in Developing Persuasive Writing Skills and Productive Habits of Mind	English	60 students from the second year of high school	Persuasive writing skills test And A measure of the productive habits of the mind	t test	The experimental group was superior to the control group in the persuasive writing test and in the measure of the productive habits of the mind

Objectives:

Al-Kathiri (2020) aimed to identify the Effect of SPAWN Strategy in Developing Persuasive Writing Skills and Productive Habits of Mind

Research Mythology The research adopted the experimental approach, which is described as "a dual methodological system in which a process of changing a certain part of the studied phenomenon (the independent variable) intersects with an active monitoring of what will happen as a result of this change (on the dependent variable) in order to verify the hypotheses claiming or denying the existence of causality between these two variables"(Al-Bahadli, 2019, p. 62).

Experimental Design: The researcher relied on the experimental design with partial control to show the effect of the independent variable (SPAWN strategy) on the dependent variable (achievement). Then, the achievement test is applied to the two research groups

(experimental and control), and then the difference between the results of both groups is calculated. The following diagram shows the experimental design used in the research:

Table (2) The experimental design adopted in the research

No.	Group	Valence	The independent variable	The dependent variable
1	experimental group	- Chronological age in months. - Raven's intelligence test -Test previous information-Previous academic achievement	SPAWN Strategy	- Academic achievement in chemistry
2	Control group		the usual way	

Research Population: The community of origin must be precisely defined before any point and the research community. The society that the researcher conducts his research on is the society itself(Mahjoub, 2005).

The community of this research was represented in the students of the second middle grade in the middle and secondary day schools for boys of the General Directorate of Diwaniyah Education for the academic year (2023- 2022).

Sample Research: A lot of research cannot be conducted on the entire community for many reasons, foremost of which is the capacity of the community, the impossibility of fully researching it, the time and cost. So the researcher resorted to using samples that represent the community adequately to establishes the generalization of the research results to the original community(Attia, 2008).

The two researchers selected the students of the second middle grade in the Al-Razi school of the Directorate General of Diwaniya Education as an intentional sample to apply the research experiment. After the researcher obtained the task facilitation books from the Directorate General of Diwaniya Education, he chose two divisions out of five divisions in Al-Razi middle school for boys by random appointment. Division A will represent the experimental group and the number of its students (32) and Division B will represent the control group and the number of its students (34) students. Thus, the total number of the research sample (66) was excluded because of their previous experience in chemistry, which may affect the accuracy of the research results.

Control Procedures:

Internal Validity for Experimental Design : The research shows honesty. The reason for the difference between the experimental group and the control group is attributed to the independent variable and not to other extraneous variables(Al-Omrani, 2013).

1. Equivalence of the two research groups:

The two research groups were equivalent to the number of variables as shown in Table (3)

Table (3) The equivalence of the two research groups with a number of variables

Variable	Group	Arithmetic mean	Variance	T value	
				Calculated	tabular
Chronological age in a month	Experimental group	162.312	59.691	0.357	2
	Control group	161.647	54.774		
Previous Achievement in Science	Experimental group	71.062	127.599	0,292	2
	Control group	70.325	137.077		
Raven's intelligence test	Experimental group	28.656	40.360	126	2
	Control group	28.441	54.552		
Test previous information	experimental group	9.834	4.844	283	2
	Control group	9.676	6.584		

2- Duration of application of the experiment : The period of time during which the experiment takes place may give way to the influence of some external factors on the dependent variable besides the experience(Abdel-Moamen, 2008). The duration of the experiment was in the first semester, and equal for the control and experimental groups, from (Wednesday) corresponding to (10/12/2022) to (Monday) corresponding to (1/9/2023).

3- Experimental extinction (experimental waste): If some of the sample dropped out for one reason or another, the difference in the performance of the remaining individuals in the dependent variable may be due to this dropout and not to the effect of the independent variable(Abu-Allam, 2011). During the experimental period, the two research groups were not exposed to any dropout, interruption of work, or the transfer of a student from one division to another, with

the exception of the few individual absences, which is a normal condition.

4 -Processes related to maturity: Maturity is the extraneous changes in the individual that occur with the passage of time and may affect the performance of the research sample. This occurs particularly in research conducted on middle school or late primary school students prior to the changes of adolescence(Abu-Allam, 2011). There are no individual differences between the students of the two groups associated with the maturity factor due to the close age of the students in the two groups. No effect on the results was found.

(b) Verification of the external validity of the experimental design:

1- Overlap between the selection and the experimental variable:

The researchers chose the two research groups out of five people randomly to reduce the influence of the selection process and the experimental variable.

2- The interaction of the experimental conditions with the experiment:

The experimental procedures carried out by the researcher may affect the two research groups in terms of feelings and attitudes, so that the situation seems almost artificial(Abdel-Moamen, 2008), which leads to the scores obtained by the sample not being representative of the scores of the original community(Al-Tayeb, Al-Darini, Badran, Al-Bilawi, & Najeeb, 2005). The researcher taught both groups under normal conditions, and the only experimental situation was SPAWN strategy that he studied with the experimental group.

3 - Interaction of experimental situations: If the individual is subjected to more than one experimentation process during a specific period of time, the effect of the previous experiments may affect negatively or positively the results of subsequent experiments and lead to the researcher's inability to generalize the results of his experiment(Abdel-Moamen, 2008). The researcher conducted the experiment on a sample that had not previously been exposed to similar experimental situations or experimental situations in the same time period in which the experiment was conducted, so these effects, which may affect the experiment, were reduced.

Research tool: The researcher prepared a tool to measure the dependent variable, which is achievement, as he prepared an achievement test in chemistry that includes the content of the first and second chapters of the book, which are within the first unit. The achievement test is of great importance because it occupies the largest part in the process of evaluating the student. The process of building the achievement test proceeds according to specific steps, the most important of which are:

A- Determine the purpose of the test: A single test can achieve many purposes at once, but these purposes must be defined in advance. Because in the first case, the teacher will prepare relatively easy paragraphs, and the sample will be limited. In the second case, most of the paragraphs will be of an average level in terms of difficulty, and it represents a wide content of the content of the study material. The aim of the achievement test is to measure or know the achievement of the students of the (experimental and control) group for the second intermediate grade related to the subject of the chemistry book during the experimental stage.

B- Determining the scientific subject: Determining the content that will be covered by the test is important, especially if the purpose of the test is to evaluate what the students have learned in the subject. It requires defining the content of the main and sub-fields and elements, and determines the relative weights of each according to its importance and the time allotted for teaching it. To determine the number of items for each field. The scientific material that was studied for the (experimental and control) group including a section of the first chapter and the second chapter of the chemistry textbook for the second intermediate grade, fourth edition of 2021.

Formulation of behavioral objectives: The test items must be developed so that they serve as a representative sample of the content of the subject and the specific learning outcomes measured. For each subject, test items must be set, the answer to which is evidence of achievement in that subject. According to Bloom's classification, the researchers formulated 169 behavioral goals, and they were presented to a group of experts in the field of teaching methods and the field of evaluation measurement.

C- Preparing a table of specifications (test map): The researcher prepared a table of test specifications in which he identifies the parts of the content he wants to measure. The relative weight of each part determines the number of paragraphs or items that measure the objectives related to that part for the purpose of providing the comprehensiveness of the test setting the necessary questions to measure the objectives of each part. of what is intended to be measured(Attia, 2008). The researcher prepared a table of specifications as shown in the table 4:

Table (4) the test map for the achievement test

Chapter Sequence	Number of courses	Content Weight	recalling, 33%	assimilation 37%	Application 20%	Analysis 7%	Installation 2%	Evaluation 1%	Number of questions
First grade	7	58%	7.656 ≈ 8	8.584 ≈ 9	4.64 ≈ 5	1.624 ≈ 2	464 ≈ 0	0.232 ≈ 0	24
Second	5	42%	5.554 ≈ 6	6.216 ≈ 6	3.36 ≈ 3	1.176 ≈ 1	336 ≈ 0	0.192 ≈ 0	16
Total	12	100%	14	15	8	3	0	0	40

D- Drafting test instructions: Test instructions represent necessary instructions that guide the student in performing the test. No matter how important the test questions are, they become useless if the student cannot write his answer to the questions(S. M. Melhem, 2012). They include the following:

-Instructions for answering the achievement test items: A number of instructions have been developed that help the student and explain to him how to answer the objective items of the multiple-choice type in the achievement test.

- Correction instructions: The two researchers gave only one mark for the correct answer and zero for the wrong answer on the test items of the multiple-choice type. Thus the highest score that the student can obtain is (40) degrees, and the lowest score is (zero).

C- Validity of the test: It is its ability to measure what it was designed for, and the importance of validity lies in the fact that it determines the validity of any scientific hypothesis(Aziz et al., 2020). The two researchers decided to find types of validity as follows:

Apparent honesty: The test must be honest; all the subjects accept it willingly. Anna Anastasi (1982) emphasizes the availability of the apparition of the test in order to be more effective and to ensure the cooperation of the examinees in the test situation. Apparent honesty can be improved by rephrasing the questions to appear more related to the situation. Actual measurement(Mikhail, 2016). The researchers presented the achievement test that he prepared and formulated its paragraphs to a group of arbitrators specialized in the field of chemistry, measurement and evaluation, as well as specialists in the field of pure chemistry, in order to express their opinions about the validity of the optional paragraphs, their linguistic accuracy, and the soundness of their scientific construction. At an agreement rate of 80%

and based on the Cooper equation, thus achieving shows the apparent validity of the achievement test.

Validity of the content: It is the analysis of the materials, paragraphs and items of the scale to see how well they represent the subject of the measurement. The researcher identifies the study material and what is required of the students of this subject. It determines the weight of each subject in preparation for the formulation of the test items according to the weight of the subject. The validity is high if the test is comprehensive and measures the extent to which all goals are achieved(Majeed, 2014). The table 4 is the specifications prepared by the researcher and achieves this kind of validity, and thus the test is ready in its initial form, as in the appendix.

The exploratory application of the achievement test: the exploratory application includes two phases:

The first stage: the first exploratory application: The researcher chose a sample from the target community, then excluded it later from the main research sample. It applied the test that he built making sure of its validity and stability, for the purpose of making sure that it can be applied and that it is free from obstacles, knowing the questions and knowing the actual time needed to apply the test(Attia, 2008). The two researchers conducted the test on the second intermediate students in the same school, but in another section other than the two research groups. The test was under the supervision of the researcher himself, and the researcher recorded the time in which the first five students finished answering, and also recorded the time taken by the last five students to answer the achievement test items. They ranged between (35-55) minutes, with an average of (45) minutes. The equation below was used to extract the average time taken to perform the test:

$$\text{Average time taken} = \frac{\text{First student time+second+third....etc}}{\text{Total students}}$$

The second stage: the second exploratory application (statistical analysis of the paragraphs): The purpose of this application was to calculate the coefficient of difficulty, ease and discrimination of the test items and the effectiveness of the wrong alternatives, and then the items that are suitable for the test are fixed after reformulation and improvement or deletion if necessary(Al-Najjar, 2010). An upper group and a lower group were selected after arranging the grades in descending or ascending order. This was called the method of the two extreme groups(Ebel & Frisbie, 1972). The Steven Thompson equation was adopted to determine the sample size in which the second exploratory test was conducted to use the results after that in the statistical analysis of the test items. The equation took into account the first saturation limit, which was the limit at which the sample size does not increase with a significant increase in the size of the

population. It also considered account the percentage of error in the sample and the standard score at a confidence level (95%)(Bashmani, 2014). Based on what was stated previously, the researcher resorted to applying the Stephen Thomson equation to extract the sample size through the use of (Microsoft Excel) program. The result of the equation was that the statistical sample had a sample size of (357) students.

To ascertain the psychometric characteristics of the achievement test, the test was applied to a survey sample in a number of randomly selected schools on Wednesday and Thursday (12/28-29/2022), in cooperation with teachers and school administrations.

For the purpose of conducting the statistical analysis of the achievement test items, the following is required:

1. Correcting the achievement test forms for the statistical analysis sample.

2. Arranging the total scores obtained by the sample in descending order from the highest score to the lowest score.

3. Choosing (27%) of the questionnaires with the highest scores, and (27%) of the questionnaires with the lowest scores, since this ratio is the best ratio compared to the two extreme groups in the response. "Kelly" suggested that the number of members of each of the two extreme groups is in the total score when calculating the discriminatory power of the paragraphs by (27%) of the members of the research sample(Odeh, 1998). In the light of this percentage, the number of questionnaires in the upper group reached (96), and the number of questionnaires in the lower group were 96. The answers were analyzed statistically and the coefficient of difficulty, discrimination, and the effectiveness of wrong alternatives were calculated, as follows:

A- Paragraph difficulty coefficient: The difficulty of the test items is one of the characteristics that play an important role in the tests and affects the individuals' answers about its items. The vocabulary should accurately distinguish between the levels of the trait to be measured. The vocabulary that all individuals answer or that one of them cannot answer is not useful in revealing the differences between them in what the test measures. Psychometric studies have shown that the test can distinguish to the maximum extent possible between the tested individuals if the average difficulty of the vocabulary it includes is 0.50(Allam, 2000). With regard to the achievement test paragraphs of the current research, which are all paragraphs of the type of objective questions, the difficulty coefficient was calculated according to its equation. The researchers found that the difficulty coefficient for the paragraph ranged between (0.421-0.625). Paragraphs were

considered good if their difficulty coefficient ranges between (0.20-0.80), with an average of (0.5)(T. Y. Melhem & Isa, 2013).

B-Paragraph Discrimination Coefficient: The value of the paragraph discrimination coefficient indicated the extent to which the scores of each item were consistent with the scores of the test as a whole. When the value of the discrimination coefficient is positive for a specific individual and amounts to 0.40 or more, it indicates that the individual discriminates between the two extreme groups. If it ranged between 0.20 and 0.40, then distinguishing the paragraph was okay. If it was less than 0.20, then its discrimination would be weak(Allam, 2000). The discrimination coefficient for the achievement test items was calculated according to the special equation for the items. The researchers found that the value of the discrimination coefficient ranged between (0.416 - 0.687), and this indicates that the vocabulary distinguishes well between the two extremist groups.

C- The effectiveness of the wrong alternatives: The effectiveness of the alternatives was evaluated by comparing the number of respondents to each alternative from the members of the upper and lower groups, and it is as follows:

1- The effective alternative is the alternative that attracts the largest number of members of the lower group

2- The ineffective alternative is the alternative that does not attract any of the members of the lower group, or the percentage of its selection in the lower group is small, and it should be deleted.

3- The misleading alternative is the alternative that attracts the largest number of members of the upper group, i.e. a higher percentage than the members of the upper group, and does not attract any of the members of the lower group, and it should be deleted(Al-Kasabiny, 2010).

The achievement test includes (40) multiple-choice items (4 alternatives). The correct answers for the multiple-choice items were randomly arranged. After applying the alternatives effectiveness equation, the values ranged between (-0.020 - -0.343). It was found that all the erroneous alternatives were negative values, and they attracted more members of the lower group than the upper group, and thus the erroneous alternatives were left unchanged as they are.

D- The stability of the achievement test: The stability means that the individual obtains the same grades if the same tool is applied to him and under the same conditions(Murad & Suleiman, 2002).

The reliability of the achievement test was calculated, which consisted of (40) objective items. using the Kweder-Richardson 20 method. Here, the scores of the sample were subjected to statistical analysis, which

amounted to (357). The stability coefficient was (0.895). It was a good stability coefficient. For a good test of the objective items that use the KR20 equation, the stability coefficient must not be less than (0.70) or more(Green & Yang, 2009).

C - The achievement test in its final form: The achievement test in its final form consisted of (40) objective items. Take scores (1,0). Thus, the highest score for the achievement test is (40). The lowest score for the test is (0).

Statistical means: The research data was processed using the statistical package for social sciences (SPSS+22) and Microsoft-Excel spreadsheets, which included the following statistical means:

1- Stephen Thomson equation determines the sample size of the statistical analysis.

2- The alpha-Cronbach equation calculates the reliability coefficient of the achievement test

3- Cooper's equation finds out the percentage of the arbitrators' agreement to extract the apparent validity of the achievement test items

4- Paragraph Difficulty Equation calculates the coefficient of achievement test paragraphs.

5- Item Discrimination Equation calculates the distinction of the achievement test items.

6- Effectiveness of false alternatives extracts the effectiveness of false alternatives for objective achievement test items.

7- One-way analysis of variance finds out the significance of the differences between the averages on the post-measurement between the average of the experimental and the average of the control, and shows the effect size of the SPAWN strategy on the achievement test scores

8- Eta square measures the effect size of the SPAWN strategy on an achievement test

Results and discussion:

The search results will be displayed according to the search variables and hypotheses, as follows:

1- Verifying the research hypothesis, which states the following:

There is no statistically significant difference at the level (0.05) between the mean scores of the students of the experimental group

who study according to the SPAWN strategy and the mean scores of the students of the control group who study according to the usual method in the achievement test of chemistry.

For the purpose of verifying the null hypothesis, the achievement test scores in chemistry were analyzed for the experimental and control groups for the post-test, and the t-test was adopted for two independent, unequal samples, to show the differences between the mean scores of the students of the experimental and control research groups. The results were as in Table (5).

Table (5) shows that the students of the experimental group outperformed the control group in the achievement test in chemistry. From the results of the tables, it appears that the arithmetic mean of the experimental group was (35,250) with a standard deviation of (2.423), while the arithmetic mean of the control group was (17.852) with a standard deviation of (5.246). When the t-test was applied to two independent, unequal samples of the experimental and control groups, the results indicated the following: The calculated t-value was (17.114), and when compared to the tabular value of (2), at a degree of freedom (64), at the significance level (0.05), it turned out to be greater than the tabular value. This indicates that there are statistically significant differences between the average achievement scores of the students of the two research groups. This indicates the superiority of the experimental group who were taught according to the steps of the SPAWN strategy over the control group who were taught according to the usual method in the achievement test in chemistry, and accordingly the null hypothesis was rejected and the alternative hypothesis was accepted.

Table (5) The results of the t-test for two samples are not equal to the difference between the experimental group and the control group in the achievement test in chemistry

No.	Group	Number of students	Arithmetic Average	The Standard Deviation	Degree of freedom	T value		Statistical significance at the level of 0.05
						nepotism	tabular	
1	Experimental group	32	35.250	2.423	64	17.114	2	significance
2	Control group	34	17.852	5.246				

To determine the size of the effect of the independent variable (SPAWN strategy) among the experimental group members on the dependent variable academic achievement in chemistry. Arithmetic means and standard deviations were calculated for the responses of both experimental and control groups in the post-test of academic achievement in chemistry. Table (6) illustrates this

Table (6) The arithmetic mean and standard deviation of the responses of students of the experimental and control groups in the post-test of academic achievement in chemistry

the test / the group	the number	Post-test	
		Arithmetic Average	
Experimental	32	35.250	2.423
control	34	17.852	5.246
the total	66	26.287	9.671

To verify the significance of the differences between the means, one-way analysis of variance was used, and the results were as shown in Table (7).

Table (7) The results of the one-way analysis of variance test for the experimental and control groups for the post-test of chemistry achievement scores

sources of contrast	sum of squares	Degree of freedom	mean sum of squares	Pecuniary value	Level of Significance
Between Groups	4989.266	1	4989.266	292.877	Significant at 0.05
Within Groups	1090.265	64	17.035		

Table (7) shows that there are statistically significant differences at the level of significance (0.05) for the post-test in the achievement of chemistry between the experimental and control groups. Where the calculated p-value (292.877) was greater than the tabular p-value (4) at a degree of freedom (1-65).

To find out the size of the effect of the independent variable on the dependent variable, the standard values set by Cohen (1988) are compared, as shown in Table (8).

Table (8) Standard values for effect size

Value	effect size
less than 0.20	Weak effect size
0.50 -0.20	Small effect size
0.80 -0.50	Medium effect size
greater than 0.80	Great effect size

Table (9) shows the effect size of the ETA square.

To find out the size of the effect of the independent variable on the dependent variable, the standard values set by Cohen (1988) were compared with the value of the Eta square that has been calculated, which was (0.906). This comparison indicated that the size of the effect of the independent variable, (SPAWN strategy) on the dependent variable (achievement in chemistry) was large, and the percentage of the effect was (82%). This indicated that the effect of the independent variable on the dependent variable was in favor of the (experimental group) as shown. in Table (9).

Table (9) Eta square value and effect size on the post achievement variable for the two research groups

the independent variable	dependent variable	Eta	Eta Squared	The magnitude of the effect
SPAWN STRATEGY	Academic achievement in chemistry	0.821	0.906	big

The results showed that the scores of the experimental group, whose students studied according to the SPAWN strategy, were superior to the scores of the other control group, whose students studied according to the traditional method used. The researcher attributes the difference between grades to a group of reasons, namely:

1 -The SPAWN strategy encouraged shy students to interact with the lesson, and thus affected their academic achievement.

2 -The SPAWN strategy gave students an opportunity to express their opinions, which increases understanding, retention of information, and academic achievement.

3 -The SPAWN strategy gave the students a large space to create a new scenario for the topic, and the student, like a superhero with the power to change the text, and this increased their academic achievement.

4-The SPAWN strategy helped to develop students' future or deductive thinking skills by presenting the phrase in the form of a question that motivates the student to think logically and thus increased the improvement of students' academic achievement.

Conclusions:

Through the research results, we can draw the following conclusions:

1- After the practical application of the SPAWN strategy in the classroom, a positive change occurred in the achievement of the second intermediate grade students in chemistry more than the observed change among the students who studied in the usual way. This indicates the effectiveness of the strategy in this area.

2- The SPAWN strategy contributed to the production of new and creative ideas, as it gives new horizons in looking at the issue from multiple angles.

3- The SPAWN strategy introduced students to enjoy studying, and this contributed to deepening their understanding of the subject and retaining information.

Recommendations:

In the light of the findings, the two researchers put forward the following recommendations:

1-Teachers should make the student the center of the educational process

2- There should be an emphasis on the need to include modern strategies in teaching scientific subjects in general and chemistry in particular.

Suggestions:

Complementing the research, the two researchers suggested the following:

1- Conducting a similar study of the independent variable in different stages and different subjects.

2- Conducting a study similar to the current study to identify the impact of the SPAWN strategy in disciplines other than chemistry.

3- A comparative study between the SPAWN strategy and other strategies to see its impact on academic achievement.

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