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The effectiveness of teaching according to the logical thinking skills in the scientific achievement of the fourth graders in the subject of chemistry

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Abstract

research aims to identify the effectiveness of teaching according to the logical thinking skills in the achievement of fourth-grade students in science in the subject of chemistry, and to verify the goal, the researcher developed the null hypothesis that states: There is no statistically significant difference at the level of significance (0.05) between the average grades of the experimental group students who will study According to the logical thinking skills and average grades of the control group students who will study according to the usual method in the chemistry test, and in order to verify it, he applied his experience in the second semester of the school year (2019- 2020 M), IT formed the research sample of(40) student of the students grade the fourth scientific in the secondary FAO Girls Was distributed n randomly into two groups of(20) student of each group, it has been rewarded with the two groups in the following variables :chronological age, IQ test , score the second course of the previous academic year in material chemistry , and test the previous information , and in the light of The relative importance of the content and behavioral purposes. An achievement test consisting of (36) paragraphs of these(27) items of multiple choice type and(9) paragraphs of the essay type were built , and the researcher verified the characteristics of the psychometric test for the test . The experiment continued(10) as I sell , and at the end of the experiment summative test was applied to the two groups , then analyzed the results showed the superiority of the students of the experimental group of Latte studied n on of IQ skills of logical thinking on the control group of the Latte studied n the usual way in the collection variable school.

Key words Logical thinking skill , students grade IV scientific , chemistry , achievement academic

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Introduction:

One of the biggest challenges facing those responsible for education is raising the level of educational attainment of the learners, and it is one of the important topics that occupied a large portion of the thinking of educational scholars and psychologists, especially in the era of knowledge explosion at the present time in which competition depends on what the learner has of Knowledge that defines his scientific future, his profession and his social standing in life, which prompted specialists and researchers to search for ways and methods to achieve success in situations facing the learner in a manner that works to overcome the problems resulting from the development of the world and the vast amount of infinite information in all situations, whether academic or life, as the goal nowadays is not to obtain information, but how to invest this information and benefit from it and harness it through active and sophisticated thinking in order to raise the learner's competence in facing problems and enable him to challenge ambiguities and surprises and increase his ability to adapt and the environment in which he lives.

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Science education in general has gained increasing attention among nations, and scientific projects have emerged to develop science education, including chemistry in terms of content and methods of teaching it, but the educational reality in Iraq indicates that its goals were not accomplished as desired and planned, and the reason for this may be derived from Some phenomena such as dropout, low achievement, and absenteeism from school, or from the negative trends that learners possess towards teachers, subject matter and the school system .The predominant characteristic of teaching at the present time is that it is distinguished by a routine method that is dominated by the character of memorization and rote memorization. The educational community has followed this approach that caused the decline in student achievement. Schools often rely on the principle of memorization and indoctrination only and conducting examinations in order to reveal the amount of information that students have memorized. This makes students adopt a rigid template in education, moving with them from one stage of study to another without a change in style, which makes students recipient of instructions without understanding, and many teachers to this day practice negative states in teaching where they are interested in filling students' ideas with dry information without their insight. By the means by which the learning process takes place, and the skills that students possess in terms of thinking methods and intelligence abilities are not developed.

One of the most important reasons for students 'poor achievement is the use of teaching methods in which the teacher is the focus of the educational process, and poor communication in the interaction between the teacher and the student, despite the recent emphasis in education on the role of the learner as the focus of the teaching process, so the teaching methods used must change To make the student an actor .For example, the method of diction is prevalent in most educational situations, which lacks the element of suspense and excitement, which led students to feel bored and lack of interest and focus in the scientific subject, which negatively affects their scientific level and thus their academic achievement, so it is considered one of the most prominent issues in the education of chemistry at the secondary stage. Focusing on both practical skills and ways of thinking, and this comes through the development of students' mental skills and attitudes, so that they form a scientific approach for them, so that they can research their surroundings and solve its problems, and those who support this approach say that developing these capabilities will enable students to respond to the changing world in which they live. In it, and to explain it logically and know how to search for evidence, investigate evidence and proof, and use that not only in the field of chemistry, but in the various aspects of their activities.

And through the experience of the researcher in teaching chemistry for secondary stages for more than (12) years, and to define the problem more precisely, the researcher conducted an exploratory study that included (10) schools of chemistry for the fourth year of middle school in some schools of the Babylon Education Directorate and after discussing the results, it was found that 90% of Female teachers are not aware of the use of logical thinking in the teaching process, and that 80% of female teachers do not have knowledge, knowledge, or idea about strategic intelligence, as well as based on the results of many studies that indicated a decrease in students' achievement in chemistry, which will be misused by the use of teaching From all this, the researcher's research problem crystallized in the need to use thinking about non-traditional teaching methods and methods provided by the teacher in order to achieve the best return in the education process, so teaching can be designed systematically leading to Adaptation of the educational - learning process to suit the needs of students, their abilities and preferences, despite the progress made in the field of methods of teaching chemistry, our secondary education is still in urgent need to develop chemistry teaching through To research the effectiveness of modern educational methods, models and strategies that may have a tangible effect in achieving important educational goals, such as using logical thinking and its skills in the teaching process and building their intelligence capabilities.

Here, the researcher wonders whether the method of using logical thinking in teaching can be an indicator of raising the level of achievement of students and their level of strategic intelligence?

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And the following table shows logical thinking skills:

Logical thinking skills	
Observation - inquiry	Data collection
Information Storage - Information remembering and retrieval	saving information

Comparison - Rating - Ranking	Organize information
Discrimination - identifying elements and components - identifying relationships and ties	information analysis
Predicting - Research and Experimentation - Induction - Creativity	Information production
Putting tests - proof - identifying errors	Information evaluation

Background theory and previous studies

Logical thinking is not necessarily confined to the thinking of scientists and philosophers, as the scientist thinks about a specialized problem within a specific field that a non-specialist can not go through, and uses in his thinking and expressing it a specialized language that is a language of conventions and symbols known to them among them, and their thinking focuses on a huge sum of information Within the field to which it belongs, as for the logical thinking that we mean, it is not determined by a specialized problem or a specific group of problems that scientists deal with, and it is not determined by a scientific language or special mathematical symbols, but rather an organized thinking that we can use in our daily life and in the activity that we exert in the practice of professional work The usual, and in dealing with people and the world around us, is an organized and purposeful thinking, based on a set of principles and rules that are present at the specialists and within the scope of their conscious feeling, but it is with ordinary people outside this scope, (Zakaria, 1990: 5).Logical thinking is one of the types of thinking in which a result is obtained from premises that include the result and the relationships it contains .Logical thinking is a necessary necessity for scientific thinking from the standpoint that scientific thinking is deductive hypothetical thinking, where hypotheses are formulated and tested experimentally in order to reach conclusions that are subject to logical rules, and logical thinking stems from direct personal experience, that is, logical thinking is available to all learners, but the learner is used in Logical thinking has two guides: the first is the functional evidence, which is represented by the information that the learner actually uses and relies on in reaching results, and the second evidence: the formal evidence, and it expresses the information contained in the introductions and his previous experiences on the subject (Laird and Messen, 2010: 137)..

Logical thinking is a mental process in which the thought moves from a known issue to an unknown issue, and our acceptance of the unknown issue depends on our acceptance of the known issue (Al-Afoun and Muntaha, 2012: 95). Logical thinking occurs when an individual encounters a problem for which he cannot find a ready-made solution or an experimental method. Because he practices it to try to find out the causes and causes that lie behind things, and it is based on theoretical evidence and evidence, and is described as intentional directed thinking that includes an intellectual effort, (Nawi, 2008: 28).

The main characteristic of logical thinking is that it depends on reasoning to understand and comprehend things. Explanation is a step in the way of analogy, and it is noticed that there is a reason to understand things by linking things with their causes and data with their results .solso However, logical thinking includes:

- Find the underlying causes of things or events.

-Study business results before performing them from the individual.

Analyzing and interpreting the introductions, then unifying them with changing the harmony between them, and finally choosing the verbal symbols to describe them.

(Ibrahim, 2005: 357).

Thus, logical thinking is considered a way to link ideas and expressions with each other, and it is a strong and good method of thought, as it is objective and that the conclusion must be followed by logic, (Bu Tayeban, 2010: 15).

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previous studies

After reviewing most of the previous studies, foreign, Arab and local, the researcher found that most of the studies dealt with logical thinking in a correlational relationship with other variables, as well as studies that dealt with the development of logical thinking as a dependent variable in the study, and as far as her knowledge she did not find

studies that dealt with logical thinking skills as an independent variable and their effect on dependent variables Therefore, it decided to mention some studies that are close to the subject of the study, as in the table()

1- **Study (Al-Hamzani, 2006**) Logical thinking and its relationship to trends and academic achievement in mathematics among middle and high school students in the city of Hail".

2- **Study) Mona Alafifih ,2014)** "the relationship between the level Meh skills survey and logical thinking abilities of the students in the tenth grade basic in Muscat / Sultanate of Oman".

Research methodology and procedures:

It includes a presentation of the procedures that were carried out to achieve the objectives of the research, starting from the research methodology and experimental design, determining the research community and its sample, the equivalence of the two research groups (experimental and control), preparing research supplies and tools, procedures for applying the experiment and showing the statistical means used , and it will be presented as follows:

The experimental design of the research : The independent variable includes the skills of logical thinking And (the usual method , (and a dependent variable) academic achievement) so the researcher used the experimental design with partial control for two equivalent groups, one experimental and the other control.

The research community and appointed :represents the research community the current i Unqualified grade fourth scientific , all in schools (secondary and junior high (day government of the General Directorate of Education in the province of Babylon , for the academic year (2019- 2020), which is not less than grade the people of the fourth scientific where about two divisions . the research sample has chosen T .researcher of) secondary FAO for girls) in the province of Babylon are intentional to conduct his research , he found t it includes three people to grade the fourth scientific) a, b, c, researcher of Division (a) way clouds random (lottery method) to represent the experimental group and the number of (20) student of the Cedar age on according to t (b) to represent the control group and the number of (20) students of which will study according (the usual way.)

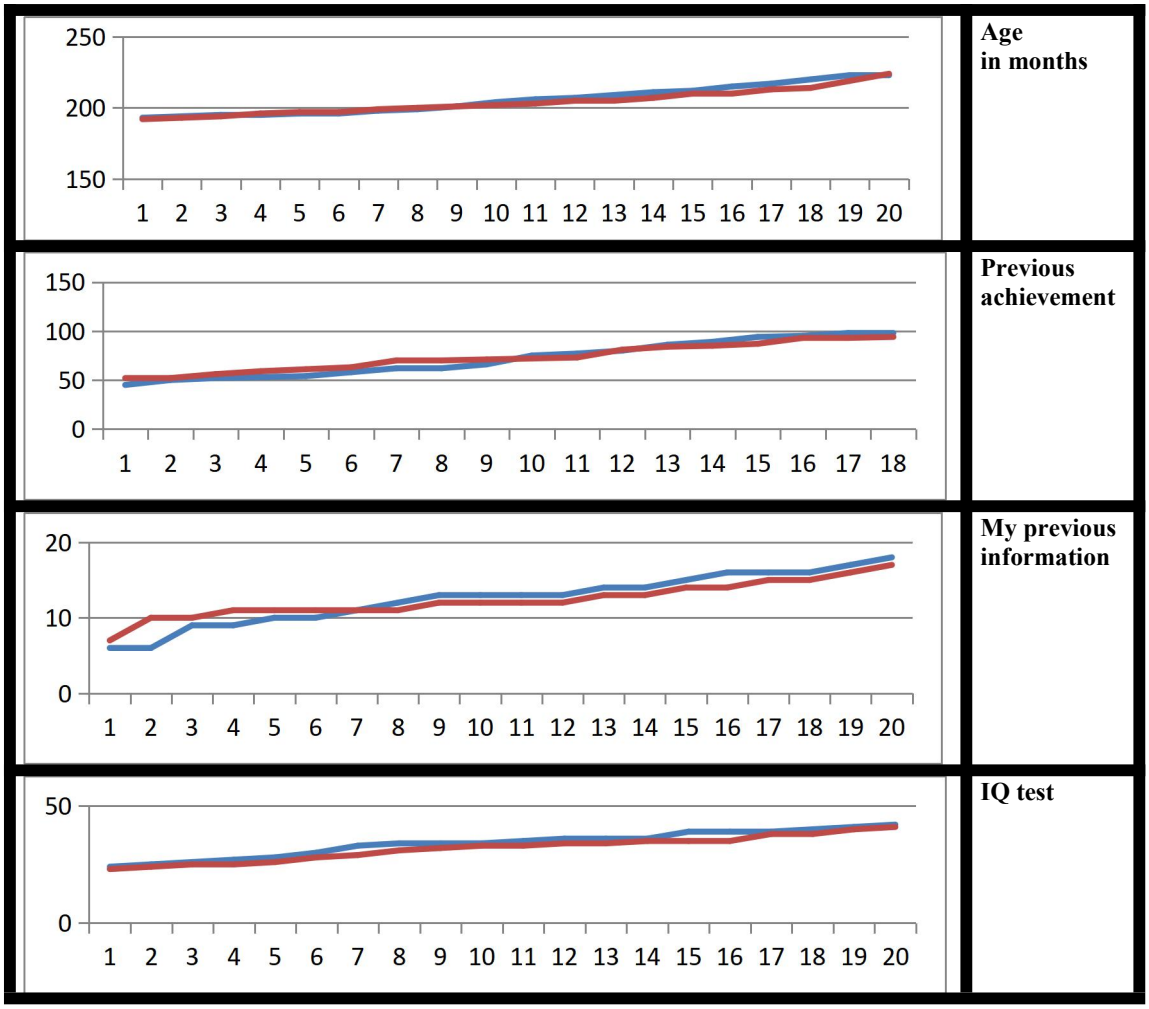
Equal two sets Search :wage T researcher Th equal statistically between the experimental and control groups in some of the variables that affect the results of the experiment, although the selection of the researcher of the two groups in a manner drag random, and even though i Alp data sample from the center of social and economic is similar to a large extent and studying in one school, but he was keen to make parity the following variables: chronological age measured in months, degrees of course the first academic year current , IQ test , test the previous information , as the T researcher of conduct parity between the two sets of research in the variables mentioned above showed the results according to the The following table:

Table (1) the parity of the two research groups , the arithmetic mean and the standard deviation

Indication level	T -value		Degree of freedom	standard deviation	SMA	Sample volume	the group	variable
	Tabular	Calculated						
Not statistically significant	2,02	**0,551**	83	**10,110**	**205,70**	20	Experimental	Age is calculated in months
				8,799	**204.05**	20	Control	
		0,215		**3, 426**	**12, 55**	20	Experimental	Previous test information
				2, 346	**1 2 , 35**	20	Control	
		0, 189-		**1 9 , 836**	**6 8 , 9 075**	20	Experimental	Grades for the second semester of the previous year
				16 , 900	**6 9 , 85**	20	Control	
		1,124		**5, 543**	**33, 90**	20	Experimental	IQ test
				5 , 424	**3 1 , 95**	20	Control	

The following figure shows the equivalence of the two research groups to the above-mentioned variables:

Control	**Experimental**	**Parity**



Adjust the extraneous variables : Although the researcher of verification of the equality of the two sets of research in some of the variables that are believed to affect the course of the experiment, but it is a tried t avoid the impact of certain variables extraneous in the course of the experiment and in some of these comes the variables and how they tuned: (associated with accidents experience: the experience was not exposed in the search to any emergency or accident impedes its progress, disappearing demo: you do not get the case of interruption or transfer of any student of throughout the experiment, sample selection: the selection of the two sets of search purposely been confirmed equal groups, factor maturity: due to the fact that the duration of the experiment unified between the two sets of research as well as the approximate age of externa baht in the two groups , so what happens growth will return to the members of the two groups at the same level, so it was not for this factor is the impact of the research, the impact of the experimental procedures: the work of T researcher of the reduction of the impact of actions Empiricism that can influence the dependent variable during the course of the experiment.(

Preparation of research requirements : The search requirements of the basic things underlying the research and that the accordingly be implemented research procedures These are requirements for: scientific material (content) have been identified scientific article that T .folk researcher of taught for i Unqualified two sets of research during the duration of the experiment (semester II (of the academic year(2019- 2020m), and scientific material included the study of organic chemistry, equations and calculations of chemical , as a promising T .researcher of (30) plan for a group of experimentation taught on of IQ skills , logical thinking and the same for a group Control that is studied according to (the usual method).

Tools and methods used: Achievement test

Research tool : Steps have been prepared for the research tool) achievement test(as follows:

Determine the purpose of the achievement test : The purpose of the envisaged achievement test is to measure achievement i Unqualified grade fourth scientific) information, skills and experience (in the subject of chemistry.

Define test objectives : Having been identified the purpose of the achievement test is to determine the objectives of the test to determine the extent achieved and the T researcher of the formulation of a number of behavioral goals.

Identify paragraphs test : The T researcher of limiting the number of paragraphs that achievement test consists of which it reached the number of paragraphs of the test (36 paragraph)

Output the test items : The items of the achievement test were formulated in their initial form in light of what was included in the test map , and the researcher chose the type and type of the test (multiple choice and essay questions .(

The test consisted of (36) test items, distributed on Bloom's cognitive levels) knowledge, understanding, Application, analysis , synthesis and evaluation , (and on content.

Test Instructions : The drafting of instructions and guidelines for how to answer represented by) choose an alternative one true paragraph , and the answer to paragraphs objective and essay , the length of time to answer, write full name and grade and the Division in the space.(

Correcting the test answers : After the test items were formulated , a standard was set to correct the answers, as (one score for each correct test paragraph) and (zero for the wrong answer, and the leftover paragraph that the students did not answer , the paragraph for which more than one choice was set) thus the final The degree supreme substantive paragraphs are (27degrees) minimum grade (zero , (either paragraphs essay was developed (two degrees) for each paragraph with a correct answer, and (one degree) to answer half correct, and zero to answer the wrong or abandoned, and therefore the final class For essay paragraphs, it is (18 degrees) and the minimum score is (zero).

Thus, the overall upper score for the test is (45) and the minimum (0).

The validity of the test : The apparent validity of the test and the validity of the content was confirmed , as the results showed that the apparent validity obtained an agreement rate (80%) by the arbitrators and the specialists, as for the validity of the content, the results showed that all the items of the achievement test are a statistically significant function , so the achievement test is considered honest in measuring the extent to understand and absorb i Unqualified grade V bio in a matter of chemistry.

The exploratory application of the achievement test: and includes the following:

- **Application Expeditionary First :**The application of the achievement test in the phase of the first reconnaissance a group of students grade the fourth scientific non - research sample, and the number of externa baht (20) student of , the purpose of knowledge and clarity of instructions and guidelines for testing and the extent of understanding and clarity of the paragraphs of the test o baht and account Length of time required for the test as the T researcher of the registration time for each student out of , and calculates the arithmetic mean of the time found that the necessary time to answer all of the paragraphs of the test is (44) minutes.
- **The second application exploratory :**The application of the test on is made up of (sample 34)، a student of grade fourth scientific non - research sample , and the purpose of the analysis of the paragraphs of the achievement test statistically and the difficulty of are wrong.

Statistical analysis of the achievement test items : The achievement test items were analyzed as follows:

- **The difficulty of the paragraph :**by conducting statistical analysis of the objective paragraphs in the achievement test , it was found that the difficulty factor of its paragraphs ranges from(0,50-0,72) while the difficulty factor for the essay paragraphs(0,44- 0,58) and thus all the achievement test items are considered good and difficult occasion.
- **Distinguishing the paragraph :**one of the important characteristics that must be provided in the test paragraphs ,which is the characteristic of discrimination, which means the possibility of items or paragraphs to detect individual differences for students and the test items are valid if the factor of distinguishing items is (20, (0and above, and the value of the parameter for distinguishing the objective items in the achievement test ranges between(0,33-0,67) either discrimination paragraphs coefficient essay ranges between(0,33-0,72) Thus, the achievement test items are considered with a good and appropriate coefficient of discrimination.
- **The effectiveness of alternatives wrong :**reward T .researcher of statistical analysis (up 27% degree and a minimum of 27% degree to find effective alternatives ranging from wrong(-0,40--0,11) and clear from that alternatives to the poorest t objective in the achievement test are all effective and thus are suitable for all counting.

Test stability :coefficient of the stability of the test depends on the relationship between each paragraph and another or between paragraphs of the test all, and evidenced by the stability of its degrees and consistency of its paragraphs , and can stability coefficient test using the legal relationship between the test units, and specifications of the test is good to be consistent and honest even paragraphs are testing with a clear meaning must be honest and fixed at the same time , indicating a match Valthbat test scores at him back in again , ie , it shows the balance of wa stability degrees externa baht in the test.

- **Methods for finding test validity:**
- **The Cronbach Alpha Coefficient :** Consistency is consistency and accuracy in measurement, and it means consistency in the set of test scores that actually measured what should be measured, (Majeed, 2014: 124). In order to extract the stability of the test items consisting of objective and essay items, the researcher used the (Alpha-) coefficient .Cronbach (for stability, and is an indicator of parity, that is, it gives good estimated values of the coefficient of parity, as well as internal consistency or homogeneity, (Allam, 2000: 166), and the stability coefficient extracted in this way reached(89,310) which is a good coefficient of stability**.**

Application search tool :the media and the two sets of experimental research officer of the date of application of the test summative week before the vote was applied after the completion of the teaching material pain set by the two sets of research at one time , and supervised T .researcher of the testing process application.

Statistical methods : Use the T researcher of the equation test Altaia (t - Test)For two independent samples to perform equivalence between the experimental and control groups , with Alpha -Cronbach's hope , and the statistical package(spss ,And the Excel program(Excel).

Results:

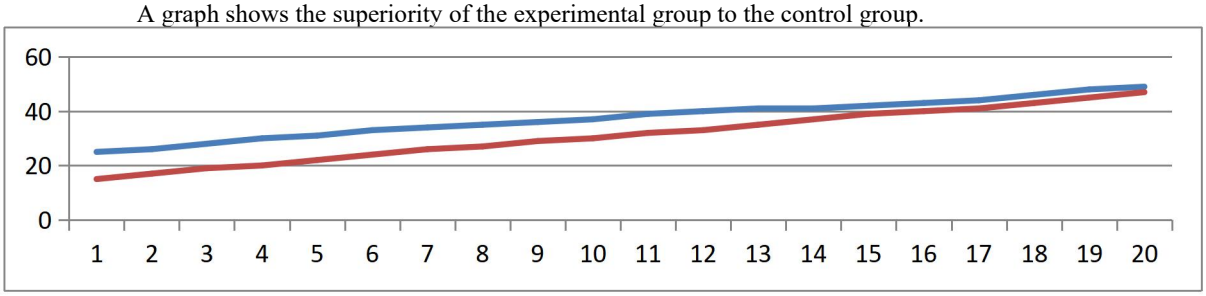
To verify the null hypothesis , which states) no difference is statistically significant at the level (0.05) between the average scores i baht experimental group of Latte studied n material chemistry on according to the skills of logical thinking and average scores i baht control group of the Latte studied n the same article according to ordinary method in the achievement test of material chemistry grade IV scientific , it has the T researcher of numbers achievement test and its application to the two sets of research experimental and control ,and after the application of the test the T researcher of correcting the two papers and the codification of degrees i Unqualified two groups , the arithmetic average of the grades account Female students of the experimental and control group and the standard deviation and variance, and then the T -test was applied t-test For two independent samples as shown in the table.

Table (2) the results of the T -test for the two research groups in the chemistry achievement test

Statistical significance (0,05)	T -value		Degree of freedom	variance	Standard dev iation	SMA	the numbe r	Statistic the group
	Tabula r	Calcul ated						
D of statistical	2,02	2,361	38	50,463	7,104	37,40	20	Experiment al
				94,261	9,709	31.05	20	Control

The calculated T value reached (2,361)which is greater than the tabular T value ,which is (2.02) at a degree of freedom(38) Thus, it becomes clear that the experimental group is superior to the control group in the achievement test, so it rejects the null hypothesis and accepts the alternative hypothesis that states: (There is a statistically significant difference at the level (0.05) between the average scores i baht experimental group of Latte studied material chemistry on according to the skills of logical thinking and the average score i baht control group of Latte studied material the same way as usual in the collection and for the experimental group)As shown in the figure:

A graph shows the superiority of the experimental group to the control group.



The researcher also used the equation square in extracting the size of the effect **(η 2)** For the independent variable) logical thinking skills (in the dependent variable (chemistry achievement) as shown in the table

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The size of the effect of the independent variable in the chemistry achievement variable

The amount of the effect size	Impact size value η2	Dependent variable	Independent variable
Average	0,128	Chemistry course achievement	Logical thinking skills

Is evident from over the table) above) that the value of the amount of the volume effect of (0,128),and when compared to the values of the size effect in the table (2) note as valuable m of appropriate interpretation of the size of the impact and by the average variable teaching (logical thinking skills) in the collection of externa Alright with chemistry and for the benefit of the experimental group,

Table(3)**Impact Size Values(η 2)And the amount of the effect**

The amount of the effect	Impact size value
Small	0,01 - 0,05

Average	0,06 - 0,13
Large	**0,14 and over**

Which means the superiority of the experimental group that was studied according to (logical thinking skills) over the control group . This shows us that teaching according to logical thinking skills had an impact positive in the understanding of scientific information and facts and interpretation of the laws of sports by cooperating groups and discuss its externa baht and this leads to raise the scientific level and raise the level of achievement have, in the light of the experience of the T by the researcher of The results obtained T .them and the reasons resulting from the research, concluded T .researcher of the following conclusions:

1- Teaching the fourth scientific students according to (logical thinking skills) had a positive effect in raising their academic achievement .
2- T .Drees grade students of the fourth scientific according to (the skills of logical thinking) had a positive impact in raising the level of high - level thinking to them .
3- Logical thinking skills (also contributed to the organization and sequence of information according to arranged and organized steps, which affects the recall and recall of information in a smooth and simple manner by the students.
4- The use of (logical thinking skills) makes the student the main focus of the lesson. Either the school is directed and guided during the lesson.

In light of presenting the results , the researcher recommends the following:

1- The use of (logical thinking skills) in teaching chemistry for middle, middle and college levels.
2- The necessity to provide the necessary time for teaching according to modern strategies and models, because chemistry is a difficult and rigid subject that contains abstract concepts and mathematical issues, so it takes a great deal of time for the information to reach the minds of the students.

-3Making use of the results of the research in (logical thinking skills) by specialists in the field of curriculum development.

Financial disclosure

There is no financial disclosure.

Conflict of interest

None to declare.

Ethical Clearance

All experimental protocols were approved and all experiments were carried out in accordance with approved guidelines.

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