

The Effectiveness Of Using Infographics In Acquiring Chemical Concepts For Fifth Scientific-Grade Students

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Abstract

The research aims to identify the effectiveness of using infographics in acquiring chemical concepts. They will study according to the traditional method in the chemical concepts acquisition test, the experimental design with partial control was chosen for the two experimental and control groups that controlled one another with the post test to test the acquisition of chemical concepts. The research community was represented by all the students of the fifth scientific grade in the governmental preparatory and secondary schools for boys affiliated to the Maysan Education Directorate, as the number of schools reached (41) middle and secondary schools. It contained (60) students distributed in two divisions for the fifth applied scientific class, with a total of (30) students in each class. By simple random assignment, Division B represented the experimental group that will be studied using the infographic, and Division A represented the control group that will study in the usual way, and was rewarded. The experimental and control research groups in intelligence, previous achievement, previous information test, prepared the chemical concepts acquisition test consisting of (36) items, and its validity and stability were verified by the Kudrow Richardson test 20 where it reached (0.80) and psychometric properties were extracted, the experiment was applied in the classroom. The first took (11) weeks, and (23) daily teaching plans were prepared for the experimental group using the infographic, and the same for the control group according to the usual method, after completing the application of the experiment. The data were statistically reconciled based on the statistical package (SPSS), the results showed that the experimental group who studied using infographics in the test of acquiring chemical concepts outperformed their peers in the control group with significant significance and a large effect size. In light of the research results, the researcher recommends the use of infographics in teaching as an alternative to the usual method, and suggests a number of suggestions.

Keywords: (infographics, acquiring chemical concepts)

Chapter One: Introduction to the Research

Research problem :

Through his experience (7 years) in teaching chemistry for the fifth scientific grade, the researcher felt that the usual teaching methods do not play their role in activating the learner's participation in the classroom, which led to the adoption of the negative role of receiving information based on memorization and indoctrination and weakness in the practice of mental processes to acquire chemical concepts,

The concepts are the fabric of scientific knowledge and its acquisition and practitioners in life situations are among the main objectives in teaching science and chemistry in particular, and this was confirmed by the study of (Daye', 2018) and the study of (Al-Bayati and Al-Obaidi 2011), and accordingly the researcher decided to search for an alternative that calls for making The learner is the focus of the educational process and in line with modern trends, and accordingly the infographic was chosen to identify the extent of its reflection on the acquisition of chemical concepts in the research sample, and accordingly the research

problem was formulated in the following question:-

What is the effectiveness of using infographics in acquiring chemical concepts for fifth-grade science students?

research importance :

Modern education will not be able to give its correct result by relying on traditional teaching methods commonly used in the educational process, in which the teacher plays the role of the tutor of scientific knowledge and the student must memorize it. The educational process where the student is the focus of it, practicing thinking skills to achieve the objectives of the curriculum in terms of knowledge, emotional and skill, which the educational laboratory aspires to in all its institutions. (Al-Maliki, 2013:5)

Accordingly, recent trends call for the use of modern methods of teaching, including the infographic method, which is derived from the theory of information processing, which has received great attention recently by international and Arab educational platforms, where they depend on it to provide diverse educational content because of its advantages in enriching the learner with information. In a short way, the infographic is one of the most important and effective means of conveying complex scientific information in a clear and easy way. The infographic is a vital tool in the education process through its great ability to represent data and information and its access to learners in an interesting way that raises their attention and interest and increases their motivation towards the learning process because of its From the ability to interpret abstract information and represent skills with high accuracy, so we see that there is a need to use infographics in the education process. (Hassouna, 2015: 2)

The infographic is one of the electronic learning tools that emerged as a result of the development of information and communication technology on the one hand, the development of learning patterns on the other hand, and it is one of the techniques used in the field of information presentation with the contemporary information revolution. It is a visual presentation of data or ideas through

which complex information can be transferred to learners in a way that can be understood in an easier and faster way. (Smiciklas: 2012:3)

The nature of infographics is represented in visual presentations of information and data, combining images, illustrations and texts in one context, as it is characterized by the aspect of creativity. Therefore, it is considered an art of design, and it is used for various purposes, including presenting information and making comparisons. It also simplifies complex ideas and facilitates the speed of understanding for the learner, and is characterized by an aspect of pleasure (Afshi: 2020: 38).

And (krum) indicates that vision (sight) is superior to all other senses, that learning and remembering are better through pictures than written or audio learning. Visual communication surrounds our modern world. Visual Communication (Krum:2013:16)

By informing the researcher of the previous literature of the concept of infographic and knowing how important it is to the educational process, and because infographic is one of the modern educational tools, it must be used in an optimal manner in order to contribute to the promotion of teaching and learning in general, and chemistry in particular, because of its complex chemical and scientific concepts that are not clear to learners. Where the infographic allows the access of the scientific content to the learners clearly and easily because of its simplicity and the elements of suspense in it and its distinctive shapes and graphics that take root in the mind of the recipient, the infographic can be divided into:

- **First: - Infographics according to the presentation method:** static, moving and interactive
- **Second: - Infographics in terms of shape and layout:** There are many types of infographics, such as (radial, tables, illustrations, graphs, relationship maps, lists, and operations). (Shaltout: 2016: 115)
- **Third: - The infographic in terms of the goal:** The goal of using the infographic is determined from among the following goals (religious, historical, commercial, educational, technical, cultural, sports, political, health and so on (Al-Jeriwi: 2015: 5)

Chemistry is one of the important sciences that have an impact on our daily lives and help simplify the components of the complex world in which we live. Facing problems and finding creative situations that encourage curiosity and give it the ability to interpret information and develop a spirit of criticism and evaluation of various possible solutions and reach the right decisions (Zangana, 2005:5)

As the teaching of concepts is an essential pillar in the educational process, it is more fertile and deeper than the teaching of facts, that the concepts are linked to each other with multiple ties and relationships and that they provide the learner with broad horizons and can enrich the work of the brain and stimulate it to research and growth. Others (Obeidat and Suhaila, 13, 2007)

Accordingly, the acquisition of chemical concepts through the practice of mental processes (definition, discrimination, application) requires the use of modern and appropriate teaching methods to ensure the safety of acquiring, maintaining and retaining the chemical concept. It is going right. (Day, 2018:136)

Through the foregoing, the importance of the research can be summarized in the following points: -

- ❖ To what extent can the use of infographics contribute to the acquisition of chemical concepts?
- ❖ The current research (according to the researcher's knowledge) is one of the pioneering research in Iraq and has not been previously addressed by researchers and postgraduate students for research projects in teaching chemistry for the fifth grade of science and its impact on acquiring chemical concepts.
- ❖ The current research is a qualitative addition to the educational library that can be used by graduate students and researchers by benefiting from its results, methodology and procedures.
- ❖ The research may provide teachers in the preparatory stage with a chemical concepts acquisition test to measure the extent to which their students have acquired chemical concepts.

Research goal: There is no statistically significant difference at the level of 0.05)) between the average scores of the experimental group students who will study using the infographic and the average scores of the control group who will study according to the traditional method in the chemical concepts acquisition test).

search limits : Fifth grade science students in preparatory and secondary schools for boys (morning) affiliated to the Maysan Education Directorate, the first course of the 2021-2022 school year, three chapters of the fifth-grade science/applied chemistry book (Chapter One: The Development of the Atomic Concept, Chapter Two: Bonding Forces and geometric shapes of molecules, chapter four: chemical kinetics)

Fifth: Defining the terms:

- ✓ **Effectiveness:** It was defined as “the achievement of the goal and the ability to achieve it, and it is the measure by which we learn about the performance of the teacher and the learner and their role in the teaching and learning process” (Atiya, 2008: 61).

Procedural definition: achieving the goal of using infographics in acquiring chemical concepts for fifth-grade students.

- ✓ **Infographic:** It is defined as the art of transforming complex data and concepts into images or drawings that are easy to understand and comprehend due to their clarity and elements of suspense.

Procedural definition: A method of using modern technology in presenting chemistry topics (under current research) to students of the experimental group with different designs of drawings, pictures and attractive colors, designed by the researcher.

- ✓ **Chemical concepts:** It is defined as an abstraction of elements that share several properties or qualities, and this abstraction usually takes a name or title that indicates it. The concept means the content of that name and its meaning. (Abu Jalala, 2005: 49)

Procedural definition: It is the ability of the research sample students (the experimental and

control groups) to define the chemical concepts that include topics under current research and to give positive and negative examples of the chemical concept and the possibility of applying those concepts in new educational situations, and it can be measured by the degree that the learners will obtain when they are tested. With the test paragraphs after completing the teaching of the chapters specified in the research.

Chapter Two : previous studies

- ❖ Al-Lahibi study (2021) The study aimed to know the effect of employing infographics on the achievement of fifth-grade students in science and their tendency towards it. The research sample consisted of (58) students from Imam Al-Mujtaba Primary School, where the control group represented (29) students and the experimental group (29) a student in the fifth grade of primary school, where the researcher adopted the experimental method, and the study tools were an achievement test and a measure of tendency. Brown, and Eta square), and the results of the study showed the superiority of the experimental group over the control group in the two study variables (achievement and inclination).
- ❖ Al-Maloudh study (2020) The study aims to identify the effectiveness of using infographics in teaching social studies in developing some visual thinking skills and motivation among third-grade intermediate students, where the research sample consisted of (60) third-grade intermediate students at Al-Amal School in Rijal Almaa Governorate, where they were divided into two groups, the experimental group numbering (30) female students and the control group numbering (30) female students, the experimental method was adopted in the study. Cronbach's alpha, t-test, and eta-square) in analyzing the results of the research, and the study found a statistically significant difference at the significance level (0.001) between the mean scores of the experimental group students and the scores of the

control group students in the thinking skills test.

- ❖ The study of Abdel Hamid and others (2020) The research aims to reveal the effect of using infographics in acquiring scientific concepts and developing chemical skills among secondary school students. Where the sample was divided into two groups, control and experimental equally, ie (20) students for each group. The experimental method was adopted in the study. The study tools were an achievement test for scientific concepts and an observation card. Alpha Cronbach, Eta square), the study concluded that the moving infographic achieved effectiveness among secondary school students in developing scientific concepts and acquiring scientific skills for the benefit of the experimental group.

Chapter Three: Research Methodology and Procedures

Experimental design: The experimental approach is defined as an organized set of procedures through which the reality of the event or phenomenon will be reshaped to reach results that confirm the validity of the hypotheses or negate them after listing all the factors and variables that affect the studied phenomenon (Al-Mahmoudi, 2019: 70). One independent (infographic) and a dependent variable is (the acquisition of chemical concepts), and accordingly the experimental design with the experimental and control groups with the post-test was chosen to test the acquisition of chemical concepts, because this design is suitable for the research variables.

Research community and sample

After obtaining official approvals (a task facilitating letter) and from the Statistics Division in the Maysan Education Directorate, the research community reached (41) governmental preparatory and secondary schools for boys. Paper clips and random selection of Echo Al-Tuff High School for Boys to represent the research sample. After visiting the school on Thursday, 11/11/2021, it was found that it includes two divisions (A and B), which numbered (60) students for the fifth

applied grade, and by simple random assignment, Division (B), numbering (30) students, represented the experimental group who will study using (infographics).), and class (A) numbering (30) students to represent the control group that will be taught in the usual way.

The equivalence of the two search groups:

- Previous achievement in chemistry: The scores of students of the two groups (experimental and control) in chemistry for the first course of the fourth scientific grade were obtained from the school records for the previous year (2020/2021), then the arithmetic mean and variance of the scores of students of the two research groups (experimental and control) were extracted.
- Previous information: In order to identify the previous information in chemistry in the current research content of the two research groups (experimental and control), the researcher prepared a test of the previous information according to the topics of the two books of chemistry for the third intermediate and fourth scientific grades, and the test consists

of (20) paragraphs (multiple choice With four alternatives) and its paragraphs were presented to a group of arbitrators specialized in teaching methods, measurement and evaluation, as well as in chemistry. The test was applied to the students of the research sample (experimental and control) on Sunday 14/11/2021 and after correcting the test according to the answer key.

- Intelligence: The researcher chose the successive matrices scale (Raven, 1983) with five groups according to the research sample category because the scale is characterized by the ease of being a non-verbal scale that depends mainly on drawings and what is characterized by its sincerity and stability, and the test was applied to the research sample for the purpose of Equivalence in the degree of intelligence on Thursday, 11/18/2021, and after clarifying the test instructions and the method of answering to the students by the researcher orally, the researcher collected the students' answers and corrected them according to the solution key of the scale.

Table No. (1) shows the equivalence variables.

Table (1) The arithmetic mean and variance of the scores of the two research groups in variables for equivalence purposes

Statistical significance	Freedom degree	T value		Adjuster		Experimental		Group variables
		Tabular	Calculated	Contrast	Average	Contrast	Average	
not significant	58	2.002	0.366	173.4	65.83	204.18	64.53	previous collection
not significant			0.226	5.36	6.43	5.11	6.30	Previous information
not significant			0.527	16.73	25.13	22.18	24.53	intelligence

Adjustment procedures (internal and external safety of the design):

- 1) **Subject teacher:** To avoid the effect resulting from changing the teacher, his personality and his style, the researcher deliberately taught himself to the

students of the experimental and control groups to avoid and control this effect.

- 2) **Duration:** The time period for teaching the two groups was set for an equal period of time, as the teaching began on Thursday, 11/11/2021, until the end of the school course on Monday, 24/1/2022, ie, at a rate of (11) weeks, and (23) experimental plans were prepared. And the same as usual and the rest of the classes to solve the questions and monthly exams.
- 3) **Study subject:** The members of the experimental and control groups studied the same subject (under current research).
- 4) **Distribution of classes:** In coordination with the school administration, the schedule of the daily classes for chemistry was arranged in successive classes on the same day for the experimental and control groups, three classes per week.
- 5) **Physical conditions:** This is to provide suitable physical characteristics for the classroom or laboratory in which the experiment is being conducted in terms of lighting, ventilation, temperature, external sound insulation, student seats and other factors (Anwar and Adnan, 2008: 221) and to reduce the impact of these conditions on students' seating areas And lighting, as well as ventilation and other conditions, the researcher intended to allocate a classroom for teaching the two groups in it, as the two groups were taught in the same hall throughout the experiment period.
- 6) **Experimental extinction:** It is represented in the loss that may occur between the members of the two research groups (experimental and control) during the experiment period (Melhem, 2000: 363). individual, which is almost equal between the members of the two research groups.
- 7) **The students who failed:** the experience was not affected by this factor because all the students were successful from the fourth grade and there were no students who failed.

search supplies

1. Defining the scientific material: The scientific material that the researcher will study for the control and experimental groups for the fifth applied grade has been determined, and as stated in the Ministry of Education book, which includes adapting the curriculum for the school year 2021-2022, where it is represented by three chapters of the chemistry book for the fifth applied grade, (2019, revised 9th edition). Which is taught in the first course:-

Chapter One: The Evolution of the Atomic Concept (partial deletion from the beginning of the chapter to paragraph (1-16))

Chapter Two: Bonding Forces and Geometric Shapes of Molecules

Chapter Three: The Periodic Table (Delete the entire chapter)

Chapter Four: Chemical Kinetics.

2. Defining the chemical concepts: The researcher identified the chemical concepts included in the content of the scientific material (under current research), as they were (12) main concepts, (29) minor concepts, and (6) sub-concepts as in Appendix (12) and to know the extent of their representation The scientific material was presented to a group of experts and arbitrators from the specialty of teaching methods, measurement and evaluation. All the concepts obtained the approval of the experts with some simple changes, and after relying on the Cooper equation with an agreement of 80% to approve the validity of the concept.

3. Formulating behavioral goals: (Al-Khazraji, 2011) defines the behavioral goal as the educational outcome expected to be performed by the learner after the teaching process, and this outcome can be measured and observed by the teacher (Al-Khazraji, 2011: 61). The researcher translated the content of the scientific material in the research into behavioral goals within Bloom's six levels of knowledge, measurable and observable. As the number of behavioral goals reached (122) goals distributed, remembering (29) goals, comprehension (50) goals, application (15) goals, analysis (16) goals, installation (6) goals, and evaluation (6) goals. It was presented to a group of experts and specialists in the field of teaching methods of chemistry, science, measurement, and evaluation, to express their views on them and their relevance and

comprehensiveness to the scientific subject. The researcher relied on Cooper's equation on the 80% agreement rate.

4. Infographic design: After analyzing the content of the topics of the chapters under the current research for behavioral purposes and informing the researcher of the websites of the infographic designs, the fixed type of the infographic was chosen, which the researcher adopted when designing the infographic for the topics of the chapters under current research, as the components of the infographic

Despite the diversity and multiplicity of infographic forms that we note, there are a number of main components that they share, and the details differ among themselves according to the taste and creativity of the designer. Among the most important components:

- ❖ The visual element and it will include the use of colours, pictures, arrows and infographics.
- ❖ Contents, which are written texts that are short and have a link to the visual element.
- ❖ The knowledge or concept, which is what distinguishes the infographic and makes it more than a text and image color, but it differs in the way it is presented, such as the concept, knowledge or content to be communicated to the recipient and includes chronology, branches and other parts. (Al-Mallah and Al-Hamidawi: 2018:33) (Ru&Ming: 2014:984-986)

Steps to design an infographic: To design an infographic, there are several important steps that govern its construction in order to produce it in a successful and distinctive manner, as (Shaltout, 2016) mentioned these stages as follows:

- **The idea:** It is what comes to the human mind of new solutions or proposals that guarantee the solution or analyzes of events and reality, and that what distinguishes the human species is thinking and its ability to create ideas, and perhaps the most difficult step for the infographic

designer to reach an idea for his design.

- **The research:** After arriving at the idea of the infographic that you are working on comes an important stage that many of those in charge of producing the infographic overlook, which is the research stage. Who is your infographic? Defining the goals of the infographic: Knowing the needs of the recipient of the information provided to him is a start to help form the goals of your infographic.
- **Analyzing the target audience:** The infographic designer must take into account the type of target audience he communicates with. The audience of a particular party may have different needs for information that differ from the needs of the audience of another. The first step in determining the content requirements is to evaluate and classify your different audiences. Information gathering and analysis.
- **Create a chart and structure for the infographic,** which usually consists of the following: (title - main parts - sub-parts - choosing colors), as these four elements are intended to plan and structure the infographic by dividing the information that was previously collected and analyzed into the previous elements so that we have an integrated scheme For the structure of the infographic before the start of implementation, after the completion of the idea and the collection and analysis of information comes the stage of creating the infographic, which is considered a step to translate the research stage, from data and information collection and analysis to the structure of the infographic
- **Design revision:** The revision stage is the stage of reviewing and verifying all aspects of your infographic in terms of reviewing to ensure that the content is complete and sequential, ensuring the correctness of the graphics used, formatting.
- **Direction:** At this stage, the final design is produced as an "infographic product" to be circulated and

published in print, mobile, or published on the Internet.

- **Publishing and Marketing:** After completing the creation and production of your infographic, it will be published to the public after it is ready for use. It may be published in print or via the Internet. (Shaltut, 2016: 130-118)

Before starting the design, the researcher looked at a series of lessons on the Shaltout.com website for teaching infographic design through a series of lectures delivered by (Prof. Dr. Muhammad Shawqi Shaltout / Professor of Educational Technology at King Abdulaziz University), and the researcher used the Adobe Illustrator program to design The shapes used in the infographic designs and the modification of some of the images and shapes downloaded from the aggpng.com website. The final output is done and the designs and shapes are adjusted and the texts are added based on the Edrwxmax program, the engineering program that is used in the design and arrangement of geometric shapes and infographic designs in order to rely on the vector to produce Pictures, drawings, and fonts where the vector is higher than the pixel, such as the pixel-based Photoshop program, as the researcher adopted it because of its advantages in high-resolution output and flexibility in use with Adobe Illustrator. (23) infographics were designed, as it fits Each design with the content of the chemistry lessons for the experimental group and how to display the infographic in distinctive colors that help attract students' attention and increase their motivation towards the lesson, In-class presentation materials from the interactive whiteboard, optical data displayer, and computer. Samples were presented to a group of referees specialized in teaching methods, psychology, computers, as well as chemistry.

Preparing study plans: It is a set of organized steps and intended skills that the teacher performs to achieve specific educational goals in the least possible time, smoothly and at the lowest cost (Al-Khazraji, 2011: 172). Prepare (23) daily teaching plans according to the (infographic) that will be studied by the experimental group and the like For the control group, which will be taught according to the usual method. A model for

each plan was presented to the experts and arbitrators in the field of science teaching methods, and by taking into account the opinions of experts and arbitrators, some modifications were made to the plans in their final form.

Preparation of the chemical concepts test:

After defining the chemical concepts of the content under the current research represented by the three chapters of the chemistry book for the fifth applied grade, which included (12) main chemical concepts (29) secondary concepts (6) sub-concepts, the chemical concepts acquisition test was prepared and based on the main concepts, as it consisted From (36) paragraphs distributed on the process of acquiring the concept. Definition (12), discrimination (12) paragraphs, application (12) paragraphs The test was prepared from the type of objective tests (multiple choice), where the researcher followed the following steps in preparing the test:

- ❖ **Test instructions:** After preparing the test and formulating its paragraphs, the test instructions were prepared, which include giving an idea of the purpose of the test, as well as how to answer the paragraphs and the time allotted for the answer. The total score of the exam ranges between (0 - 36), where one score is given for the correct answer and zero for the wrong or left out answer, as well as for the paragraphs that are answered with more than one choice, and the researcher has prepared a key for the answer.
- ❖ **Ostensible honesty:** apparent honesty means that it refers to what appears to be measured. It means that the choice appears to be true for the test users, examiners, and examinees. It is a kind of social acceptance of the test, and it is directed in general. The test must be outwardly honest and the examinees are not convinced of it. (Omar and others, 2010: 196), and in order to verify the validity of the test of acquiring chemical concepts, its paragraphs were presented to a number of arbitrators and specialists in methods of teaching science,

measurement and evaluation), and it was agreed by (80%) of the arbitrators' opinions according to Cooper's equation, and according to these opinions I made some adjustments and changed what was needed, so all test items were considered valid for the purpose for which they were made.

- ❖ **Content validity:** The content validity must represent the content of the test in two dimensions, the first being the study subjects fully, and the second the educational objectives. In addition, the researcher prepared the test based on chemical concepts, and three paragraphs were developed for each concept (defining the concept, distinguishing the concept, applying the concept), and in light of the previous procedures, the test became ready for application.
- ❖ **The exploratory application:** The application was carried out in two exploratory stages:
 - ✓ **The first:** to know the time of the test, as well as what questions the sample students will raise about the paragraphs and instructions for answering.

Accordingly, it was agreed with the school administration (w/ Abu Turab for Boys) to implement the research tool. After completing the teaching of the current research content chapters, (35) students were randomly selected for the initial survey sample, the students were informed a week before the test date, and a test was applied Acquisition of chemical concepts on the sample on Sunday 16/1/2022, the time was calculated through the arithmetic mean of the answers of the first three students and the last three students, and the average time for the answer was (38) minutes, and no question was raised about the answer instructions as well as the test paragraphs.

- ✓ **The second:** to identify the psychometric properties of the chemical concepts acquisition test, and accordingly it was agreed with the administration of the school (P / Maitham Al-Tamar for boys) to apply the research tool after the completion of teaching the chapters of the current research content.

The 100 students were informed a week before the test date, where the researcher applied the chemical concepts acquisition test on Thursday 20/1/2022.

The researcher supervised the application of the chemical concepts acquisition test. After correcting the answers, they were arranged in descending order, and (27%) of the upper group (27) answer sheets were taken, and (27%) of the lower group (27) answer sheets, and accordingly, the highest and lowest score ranged (31-8) for the concept acquisition test. The chemical and psychometric properties of the test paragraphs were extracted, which are:-

A- Difficulty coefficient: It is the ratio of students who answered correctly on the paragraph to the total number of students. After applying the equation of the difficulty coefficient for the objective paragraphs of the chemical concepts acquisition test, it was found that it ranges between (0.33-0.72). The paragraphs are also considered good when their difficulty coefficient ranges between (0. ,20-0.80) (Mulhem, 2000:238).

B- Discriminatory power: The aim of determining the discrimination coefficient for each paragraph is to know the paragraph's ability to distinguish between the upper and lower group. It is correct from the students of the lower group (Murad and Amin, 2005: 218), and the discrimination coefficient for each paragraph was calculated using the discrimination equation for the objective paragraphs and it was found that it ranges between (0.22 - 0.62). Discriminatory ability (0.20) or more.

C- Effectiveness of Wrong Alternatives: An incorrect alternative is considered effective and acceptable when the number of students who chose it in the lower group is greater than the number of students who chose the same alternative in the higher group. The aim is to obtain negative values for the incorrect alternatives. (Abu Fouda, 2012: 121), and in order to calculate the effectiveness of the alternatives for the test periods for acquiring chemical concepts, the alternatives effectiveness equation was applied and found that it ranges between (-0.26 - -0.03) all the alternatives were effective and attractive to

weak students, and therefore it was decided that the alternatives remain as they are.

D- Test stability: It means the consistency and consistency with which the test scores measure the characteristic or the thing that the test is prepared to measure. Where the test is on this individual. (Melhem, 2017: 290-294), the stability of the scale was extracted using Keoder Richardson K.R-20 equation, and it is used to extract the stability for the test of acquiring chemical concepts. Research in the field of measurement and evaluation concluded that the test is stable, as its stability value was (0.70 and more) (Murad and Amin, 2005: 360), and thus the test was ready for application.

Executing the experiment:

It was applied to the research sample (experimental and control) starting from Thursday 11/11/2021 to Monday 24/1/2022 in the first semester with three lessons per week for the two groups (control and experimental).

1-To extract the equivalences, the following was done:

- ❖ Exam (previous information) on Sunday 14/11/2021
- ❖ IQ test (Raven) on Thursday, November 18, 2021

2- The researcher studied the students of the current research sample himself, where the experimental group studied using the infographic and the control group in the usual way. In the same time period according to the teaching plans prepared by the researcher, where the researcher divided the experimental group into small groups and symbolized them in English letters in order to develop the spirit of participation in teaching using infographics. The cards and we present the most accurate answer that the students reached, based on the opinion of McCartney (McCartney, 2013), where it showed how to use infographics in education with the following points:

- ❖ The correct infographic must be chosen as it is the most important part of using the infographic in the lesson plan. Therefore, drawings must be used that provide an opportunity for students to

discover conclusions on their own. To achieve this, the teacher needs to ask himself several questions before using the infographic in the classroom. Does the infographic use information Can they be verified? Does it show students the best example of how to present information graphically? Do the displayed graphics distort the information or not?

- ❖ Giving the students the opportunity to analyze the drawings on their own, so that the students are placed in small groups and each group is asked to express their initial idea about the lesson.
- ❖ Collecting the conclusions of the groups and extracting common ideas, while supporting their conclusions and ideas with evidence they found in the infographic, whether it was moving or fixed.

3-The researcher applied the concepts acquisition test to the students of the two research groups on Saturday 22/1/ 2022, after which the answers were corrected and scores were obtained for the chemical concepts acquisition test for the two research groups.

Statistical means:

In order to achieve the goal of the research, the researcher adopted the statistical package (SPSS) in conducting statistical operations.

Chapter Four: Presenting the findings and recommendations

After correcting the answers of the students of the research sample (experimental and control), the arithmetic mean of the experimental and control group was calculated (25.9), (19.83), respectively, and the variance (27.47), (23.39), respectively, using the t-test for two independent samples of equal number. There is a difference between the mean scores of statistical significance in favor of the experimental group members who studied using the infographic in the test of acquiring chemical concepts for the students as in Table No. (2).

**Table (2) The arithmetic mean, variance and T-value of students' scores
The two research groups (experimental and control) in the concept acquisition test**

Statistical significance	Freedom degree	T value		Contrast	SMA	number of people in the sample	Group
		Tabular	Calculated				
Statistical function	58	2.002	4.659	27.47	25.90	30	Experimental
				23.39	19.83	30	Adjuster

The experimental group who will study according to the infographic and the average scores of the students of the control group who will study according to the usual method in the test of acquiring chemical concepts and accepting the alternative hypothesis.

The result of the research was in agreement with the study (Al-Lahibi, 2021), the study of (Abdul Hamid et al., 2020) and the study (Al Muluth, 2020) in terms of the influence of the infographic on the educational process, that is, the superiority of the experimental group over the control group in the concept acquisition test.

Impact size:

The effect size measures the strength of the relationship between the variables in the study, meaning that the effect size is a number that indicates the amount of importance of the study result, such as the strength of the relationship between two variables as a result of the change resulting from the intervention of the independent variable with the dependent variable using one of the statistical impact size measures according to the study sample. (Abdul-Majid 53: 2004) and to calculate the size and strength of the effect caused by the independent variable represented by the use of infographics in the acquisition of chemical concepts by students of the experimental group. By using the equation for calculating the effect size, the value of (eta square) and the effect size was extracted on the acquisition of chemical concepts for the students of the experimental group. control group.

Interpretation of the results:

In light of the results, the high scores of the experimental group who studied using the infographic over their peers in the control group who studied according to the usual method in the test of acquiring chemical concepts with a

statistically significant difference can explain the reason for this superiority to the reasons.

- Teaching using infographics presents scientific material in an exciting and attractive way that mixes words and images, as the infographic has distinctive characteristics in visually displaying the complex relationships (formal) of chemical concepts with the educational situation, as it was distinguished by being arousing the attention of the experimental group members by asking questions and limiting From the distraction of their thinking during the lesson, which increased their interaction and made them participate in the lesson through the sense of sight, which is an essential input for information.
- The use of infographic designs that include chemical concepts using visual means, the interactive whiteboard and data show, drew the attention of students to perceive the relationship between concepts graphically and analyze the form of the design, which helped to increase the activity of introverted and low-level students.
- The presentation of the infographic designs helped the students of the experimental group who were studying to define the chemical concepts (research content) and distinguish between them and thus led the students to apply these concepts in new situations, which had a great role in the learners' acquisition of chemical concepts, as well as the ability to compare information and clarify The most distinctive features of the topic effectively and this is what the

researcher sought from the results of the current research.

- Also, the use of infographics in chemistry lessons is a vital tool in the process of acquisition through its great ability to represent data and information and its access to learners in an interesting way that raises their attention and interest and increases their motivation towards the learning process because of its ability to interpret abstract information and represent skills with high accuracy.

Conclusions: In light of the results of the current research, the researcher came to the conclusion that teaching chemistry using infographics had a large impact in acquiring chemical concepts.

Recommendations: In light of the results of the current research, the researcher recommends the following:

- ❖ Emphasis on the necessity of using infographics in teaching chemistry for the preparatory stage for its effectiveness in acquiring chemical concepts
- ❖ Training chemistry teachers on how to use infographics in teaching as an alternative to the usual method.
- ❖ To train chemistry teachers on the skills of designing and producing infographics.
- ❖ Equipping the halls and chemistry laboratories with the necessary materials and equipment to assist the teacher in presenting and presenting the infographic to his students.

Suggestions: - To complement and develop this research, the researcher suggests conducting the following studies:

- ❖ Conducting a study to identify the effectiveness of the infographic in the achievement of fifth grade students in science and the development of skills of its various types
- ❖ Conducting a study to identify the effectiveness of the infographic in acquiring concepts for another subject.
- ❖ Conducting an evaluation study for chemistry textbooks for the preparatory

stage and the extent to which infographics are used.

- ❖ Conducting a study to identify the effectiveness of the infographic in the achievement of fourth-grade students regarding other variables such as high-ranking thinking, preventive awareness, or one of the other thinking skills.

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