

Effectiveness of the Suchman model in acquiring chemical concepts among fifth-grade students

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Abstract

The aim of the current research is to identify the effectiveness of the Suchman model in acquiring chemical concepts among the fifth grade scientific level students, and to verify the goal of the research, the following null hypothesis was formulated

- There is no statistically significant difference at the level of (0.05) between the average scores of the experimental group students who studied according to the Suchman model and the average scores of the control group students who studied according to the normal method in the concept acquisition test. The current research community was represented by the fifth grade scientific level students in the secondary and preparatory schools for government girls affiliated with the Directorate of Karbala Education for the academic year 2021-2022 AD. By random selection, Al-Farouk Prep for girls was chosen from among the schools of the current research community, as it included three divisions (A , B, C). The two divisions (A) and (C) were chosen by simple randomization to represent (C) the experimental group of (35) students, which was studied according to the steps of the Suchman model, and similarly, from Division (A) to represent the control group, which was studied according to the usual method. The experimental design was adopted with two groups (experimental and control), which partially control one of the other two Of those with a post-test in acquiring chemical concepts, the experiment was applied in the first semester of the academic year 2021-2022 AD , and it lasted (11) weeks. The researcher herself studied the two research groups, chemistry for the fifth scientific level grade, and it was four sessions a week. The two research groups (experimental and control) were rewarded in a number of variables, including (the previous year's achievement level in chemistry , the previous information test, and intelligence). The content of the current research was determined by three chapters of the chemistry book according to the omissions of the Iraqi Ministry of Education, if it was analyzed to conduct purposes, which reached (148) behavioral purposes in light of Bloom's classification of the knowledge field for the first six levels (remember , understand, apply, analyze, compose, evaluate), and prepare (44) daily teaching plans for the group The control according to the usual method of achieving the goal of the research, the researcher prepared an objective tool e represented by a concept test consisting of(42) concepts of the type of multiple choice, and the validity of the chemical concepts acquisition test tool and extracting its stability according to the Kuder Richardson equation -20 , as it reached (0.84) , as well as the extraction of psychometric properties. After the completion of the experiment, the concept acquisition test was applied to the students of the two groups of the current research sample (experimental and control) and then processing the data statistically using the t-test for two independent samples equal in number. The results indicated the superiority of the experimental group students who studied according to the steps of the Suchman model over the students of the control group who studied using the usual method in the test of acquiring chemical concepts and with a large effect.

Keywords : Suchman Model, Acquisition of Chemical Concepts.

Article One

First: Problem of research

The world is witnessing continuous development and a comprehensive scientific renaissance in various fields of life, as it is the era of rapid changes and developments, so it is a great responsibility on the shoulders of educational institutions to keep pace with the characteristics and requirements of this era and help individuals to absorb the huge amount of knowledge and use it in their lives (Hamah, 2019: 19). Where it has been proven that the educational systems in their traditional stages are insufficient to reach the goals followed by societies, especially the developing ones, and this is what prompted educators to confirm that there is a basic problem facing educational and educational institutions represented in the low level of acquisition of concepts in chemistry due to the use of traditional teaching methods and methods that depend on conservation and indoctrination, and the lack of

interaction of students with what they learn (Tahir, 2008: 2), while the study (Al-Masoudi, 2021) indicated that there is difficulty in learning chemical concepts by students and their reliance on deaf preservation in preserving the material and thus not to retain chemical concepts, which reflects negatively on their academic achievement and has shown the reason for this to adopt traditional methods of teaching as well as the lack of laboratories and if found lack of readiness (Al-Masoudi, 2021: 244).

Accordingly, the research problem was formulated with the following question:

•What is the effectiveness of the Suchman model in acquiring chemical concepts among fifth-grade scientific level students?

Second :Importance of Research:

no one argues with the fact that Education is the core basic of any society Development , Therefore, educators exerted no efforts in developing societies, by paying attention to education; Because it is the best intellectual product reached by man (Al-Khresha, 2013: 160), it seeks to bring about change in individuals by enabling them to adapt to their society and the changes of the era in which they live. It is one of the best survey models that aims to train students in systematic research using the survey technique, to enable them to form hypotheses about an unexpected event by offering experiences opposite to what they have, with the aim of raising doubts in them in order to re-learn them in a sophisticated manner, in which the student is active And active (Al-Amri, 2012: 240). The importance of concepts also lies in being the main pillar in learning and learning the cognitive structure of the subject, as well as their effective contribution to reorganizing and building knowledge in curricula and textbooks (Nazzal, 2002: 36). This is because they constitute learning units. And without the basic concepts, the facts are accumulated, and the learner cannot realize the relationships between them, and employ them or apply them in new situations, as well as to perform mental operations on them, i.e. thinking (Al-Hilah, 1999: 62).

Through the above, the importance of the current research can be summarized in the following:

- Activating the role of education is a necessity for the development of societies and the advancement of the ethical educational reality in them.
- The use of modern educational models as it is one of the educational methods that help to address the shortcomings in the employment of direct scientific expertise.
- The importance of chemistry as a basic pillar of science through which society can develop and solve its problems.

Third: The objective of the research and its hypothesis

The research aims to identify (the effectiveness of Suchman 's model in acquiring chemical concepts among fifth-grade scientific level students) and to achieve the goal, the following zero-sum hypothesis was formulated:

- 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 Suchman model and the average scores of the control group students who study according to the normal method in the concept acquisition test.

Fourth : The limits of the research :The current research is limited to:

- Students of the fifth grade scientific level /biological in Al-Farouq Preparatory School for Girls belonging to the General Directorate of Education in the Holy Governorate of Karbala.
- The first semester of 2021-2022 AD, morning study.
- The subjects of study included (for the first, second and fourth semesters) of the book of chemistry scheduled for the fifth year of biology, 7th edition, for the year 2018, Ministry of Education, Republic of Iraq.
- Use of the Suchman model in teaching biology to fifth graders (research sample).

Fifth : Definition of terms

First : Effectiveness : (Qatami) defined it as: The ability to make an effect and the effectiveness of an object is measured by its effect on something else(Qatami,2004: 475).

- Procedurally, it defines it as: The growth that the Suchman model has developed in the acquisition of chemical concepts and formal thinking among fifth-grade biological students (experimental group) during the period of application of the experiment and is measured using a special equation that the researcher used to extract the effectiveness of the model after applying the research tool (chemical concepts) prepared by the researcher for this purpose.

Second : Suchman Model (Suchman) Defined by:

- Ghabawi and Abu Shira 'a that: It is one of the educational models that adopt the investigative approach in teaching, which is the entrance in which the student is the focus of the educational process by placing him in an educational position that requires him to think and organize ideas and present them logically and soundly to access knowledge (Ghabawi , 2010: 27).

- The procedural definition of the Suchman model: A set of overlapping and interrelated educational procedures and steps adopted by the school within the classroom that help students (the study sample) to investigate according to the stages and steps described by Suchman to reach the desired goals of increasing the chemical concepts of students in the chemistry prescribed for the fifth grade scientific level (biological).

Third : Acquisition of concepts defined by:

- Humpty : The acquisition of the concept is a matter related to the subject of the disclosure of the attributes and connotations related to the concept, so the acquisition of the concept can be seen as a movement of the ability to generalize or the ability to systems these meanings or group them under the name, position or accident, i.e. the student's ability to put characteristics, features or examples in a class or category " (Humpty, 2019: 51).
- Procedural definition :It is the ability of students (the research sample) to define, distinguish and apply chemical concepts and it is represented by the degrees that students will receive in the test prepared for this purpose).

Chapter Two :

Theoretical background and previous studies

This chapter includes a brief presentation of two themes included in the current study:

The first topic : Theoretical background.

First: The Constructivist Theory:

Concept of Structuralism: The structural theory is an educational theory in which the student forms his own knowledge that he stores inside his mind , and that the student forms his own knowledge either individually or collectively based on his current knowledge and previous experiences , and he selects and converts information and form hypotheses and makes decisions based on the conceptual environment that enables him to do so , in the presence of the facilitator teacher of the educational process (Khairy, 2018 : 59).

Second: Survey

The **concept of investigation:** The concept of investigation in its essence indicates that it is a process , and that each process (process) includes the meaning of development and change, it is an organized mental process that includes activities to solve a problem that challenges the thinking of the learner, and it is a pattern or type of education in which the learner uses skills and trends to generate, organize and evaluate information. The learner examines and tests a situation , in search of honest information and facts. Therefore, it is part of the solution of the problem, and it is included in solving the problem, and it does not solve the problem without investigating and the investigation comes in the light of the problem, so the investigation aims to develop the thinking of the learner, and the learner has a positive role in it, as he is the one who collects, classifies and tests the data and reaches the results (Al-Ayasra, 2012: 391) .

- Suchman Survey Model

The survey education model falls under the cognitive education models , and deals with the training of students in systematic research using the survey by forming theories about an unexpected event that surprises them, although they are familiar with it. Richard Suchman developed such a model of investigative education to teach students the processes of research into phenomena and practice procedures somewhat similar to the procedures used by scientists in obtaining and organizing knowledge and generating principles and theories , and since this pattern depends mainly on the idea of scientific research, he tries to provide students with the skills and terminology of scientific investigation. In developing the pattern, Suchman carefully analyzed the methods and procedures used by innovative researchers , especially in the field of science , and after identifying them, he formed an educational pattern that he called training or investigative education (Marei , 2005 : 153).

- Advantages of the Suchman survey model:

The Suchman survey model has a set of advantages:

1. The Suchman survey model is a cognitive education model.
2. Focuses on the training of students through the scientific processes involved in scientific methodology in research and thinking.
- 3 - The Suchman model requires the student to use his senses, mind, and intuition in integration and harmony to solve the problem faced; according to this scenario, the Suchman model of investigation is based on hearing, sight, conscience, works of mind, and thinking processes (Karmin, 2021: 175).

- Defects of Suchman Survey Model

Suchman's survey model has several disadvantages , including: -

- 1- It requires teachers with a high degree of educational preparation, and therefore it is difficult to use it by teachers who lack the necessary competencies to use it.
- 2- It takes a long time in the preparation phase, and the implementation phase, and hence the gain that this model brings in learning certain topics may be at the expense of other topics.
- 3- Some students do not have the ability to do the investigation (Al-Hasnawi, 2019: 62).

Third : Acquisition of concepts

Concepts: Today, concepts are no longer just an aspect of learning, but a central focus of many curricula. Concept definitions are numerous. Logically, the concept is seen as "a set of common characteristics and traits that distinguish the set of objects, accidents and symbols from other groups". There are many definitions in which the concept was described, but they were similar in terms of content, as the concept is not just names, words, terms or symbols that formed in the storage of memory. These organizations have gone through several mental processes, the most important of which is discrimination and generalization, until they reached the final stage, at which a specific name or symbol can be given to them, and this process cannot take place in isolation from the individual's previous experience, as it is an ongoing process of building and demolishing the mental structures of the individual. The scientific concept is not very different from the definition of the concept in general (Al-Khalili et al., 1996: 10-11).

The second topic : Previous studies

- **First: Studies related to the Suchman model**

- **Studies on the acquisition of chemical concepts**
Section The Third

| Researcher, Country and Year of Completion | Study Title | Objective of the study | Study sample | a Method of study | Statistical means | Study Findings |
|---|---|--|---|---------------------------|---|--|
| Al-Masoudi Study, KhitamHam ed Ibrahim Hamadi (2021): | Instructing by media in the light of the theory of multiple intelligences in the acquisition of chemical concepts among fourth-grade scientific level students. " | Knowledge of the effects of teaching in the light of the theory of multiple intelligence in the acquisition of chemical concepts among fourth grade scientific level students. " | 55 students divided into two experimental groups and an officer | Testing Chemical Concepts | T correlation coefficient Spearman Brown correlation coefficient k Square | There are statistically significant differences in favor of the experimental group |
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Research Methodology and Procedures

1. Residential Methodology

In her research on the experimental approach, the researcher followed the natural suitability of her research because it is the most accurate research that can affect the natural relationship between the independent variable and the dependent variable in the experiment. Instead of abbreviating to describe what is present, the researcher introduces changes and notes the results, and this is done through his study of opposing positions and depends on careful observation of the phenomenon to be studied (Wolfolk, 2015 : 87).

- **Experimental Design** :It means " the action plan that the researcher takes in his experiments to start safely, the method of choosing his experimental units, distributing them through a specific system, and ending in a standard way for the outputs" (Bin Jajdal, 2019 : 66) diagram (1) shows this .

Scheme No. (1) Experimental design of the members of the two groups (experimental and control)

| The two groups. | Équivalence | The independent variable | Dependent variable |
|--------------------|---|--------------------------|-------------------------------|
| Experimental group | - Previous Collection - Testing previous information Yes, brains. | Suchman Model | -Choice of acquiring concepts |
| Control group | | The usual way. | |

Second: Research Community & Sample

A. Research Community

It is all the vocabulary of the phenomenon that the researcher wishes to study, especially all individuals, objects, or persons who are the subject of the research problem (Al-Jabri, 2011 : 245). The current research community represents all female students of the fifth scientific level /biological grade who study in all government daytime preparatory and secondary schools affiliated with the General Directorate of Education of the Holy Governorate of Karbala for the academic year (2021-2022). The number of female students * (2099) students distributed over (15) preparatory and secondary schools for girls.

B – The research sample Sample: It is defined as "a model that includes an aspect or part of the units of the original community concerned with the research that is representative of it so that it carries its common characteristics and this model or part enriches the researcher to study all the units and vocabulary of the original community" (Al-Kandalji; 2019: 186).

The current research sample (Al-Farouq Preparatory School for Girls) was chosen intentionally from one of the secondary and preparatory schools affiliated to the General Directorate of Education in the Holy Governorate of Karbala for the academic year (2021-2022) , if the research sample was chosen by random appointment by drawing lots for Division (A) and (C) and a division (C) was chosen representing the experimental study that will be based on the model of Suchman by (35) female students and Division (A) represents the control group that will be studied according to the usual method by (35) female students.

Third: Equivalence of the Research Groups

Before the start of the experiment, the researcher applied the experiment equally between the students of the two research groups in some of the variables that may affect the results of the research, which are (previous achievement in chemistry for the fourth scientific level grade, information prior to chemistry for the fourth scientific level grade , and Raven 's intelligence test, Table(1) shows this:

Table (1)

Values for arithmetic mean, standard deviation, calculated and tabular T value for the three variables

| Variables | Experimental(35) | | control(35) | | T value(0.05) | |
|---------------------|------------------|--------|-----------------|--------|---------------|------------|
| | Arithmetic mean | StDev | Arithmetic mean | StDev | tabular | Calculated |
| previous collection | 74.514 | 15.071 | 73.142 | 14.225 | 2 | 0.391 |

| | | | | | |
|-------------------|---------|-------|--------|-------|-----|
| Prior information | 11.114 | 1.890 | 10.857 | 2.088 | 994 |
| intelligence test | 245, 39 | 7.558 | 37.771 | 7.352 | 540 |

Table (1) showed the equivalence of the two groups with the extraneous variables, as the calculated value of any of them did not reach the tabular value of (2) at the level of significance (0.05) at the level of freedom (68), and thus equalized this.

IV. Controlling for Extraneous Variables

It is precisely intended to stabilize all factors except for the factor whose effect is to be known, and control is one of the important elements in the researcher's control of her work and the success of her experiment, and the researcher gains high confidence by studying it, and therefore leads to results of scientific value, so the researcher should identify the variables and factors (in the independent variable) that affect the dependent variable and work to stabilize them except for the variable whose effect is to be measured (Rauf, 2001 : 22), and among these variables:

1- **Subject:** Then teaching the two groups (experimental and control) the same subject represented (in the first, second, and fourth chapters) of the chemistry book scheduled for students of the fifth grade of bioscience, 7, for the year 2018.

2- Teacher of the subject:

Emphasizing the objectivity, the researcher herself studied the students of the two research groups in order to avoid differences in the treatment of the two groups of students and as a result of the differences resulting from the personal characteristics of the teachers, the method of teaching, their teaching methods and the level of teaching, especially in terms of experience, qualification and service, and this by its nature gives the experience a high degree of accuracy and objectivity.

3. Educational environment (place of experiment):

The researcher applied the experiment in one school (Al-Farouq Preparatory School for Girls), for the purpose of conducting safety rules and applying social distancing to avoid the spread of the Corona virus among students, and they are represented in two classes that are almost similar in terms of design, space, lighting, classroom capacity, ventilation, number of seats, number of students, and the social environment that is close, which excluded the effect of this factor on the progress of the experiment.

4. Confidentiality of the trial:

The researcher was keen on the confidentiality of the experiment by agreeing with the school administration and the school of the subject not to tell the students the nature of the research and its purpose, so as not to make any change in their activity or their dealings with the experiment, which may affect the integrity of the experiment and its results.

5- Duration of the trial:

The experiment lasted for the same period of time for the experimental and control groups and included the first semester of the academic year (2021-2022), as it began to apply the experiment on Monday (7/11/2021) and the experience ended on Wednesday (26/1/2022).

6- Distribution of Shares:

The rations were distributed according to the weekly distribution schedule in agreement with the school administration. The number of rations for the fifth grade of chemistry (four rations) per week for each group. Due to the current situation of the outbreak of the Coronavirus, the number of classes became (three rations) per week for each group and a ration per week electronically through the platform (Zoom) for each group.

Fifth: Research Supplies The Research's Requirement

In order to prepare the research requirements, where (study plans for both experimental and control groups) the researcher conducted what is necessary:

1- **Determining the scientific material:** Before starting and applying the research, the researcher identified the study material for research in chemistry, within the curriculum for the fifth scientific level / biological grade, the seventh edition for the year 2018 for the first semester of the academic year (2021-2022), which included the following chapters:

- Chapter One – Developing the Atomic Concept (Quantum Preparation).
- Chapter Two – Correlation forces, geometric shapes between molecules
- Chapter IV. Solutions

2. Chemical conceptualization

The researcher identified the chemical concepts within the content of the book for the three chapters mentioned above, and their number reached (14) main concepts and(34) secondary concepts and sub-concepts (2) .

2. **Formulation of behavioral goals:** It is necessary to define behavioral goals, as it facilitates the selection of appropriate experiences and the selection of appropriate educational activities for learners, as well as helps in choosing the teaching method, teaching methods and evaluation methods appropriate to the content of the educational material (Razouki, 2017 : 91), the behavioral goal is "a phrase formulated precisely and clearly to describe what is expected to happen in the student's behavior, which he is doing after passing through new educational experiences related to the vocabulary of the lesson / concepts contained therein, where it can be observed and measured (maximum: 2018, 84-83), as the number of behavioral goals formulated reached (148) behavioral goals distributed according to the classification of cognitive Bloom at his six levels, and the researcher has presented them from arbitrators specialized in educational and psychological sciences and methods of teaching science; to indicate their opinion on their safety and conformity with the conditions of formulating behavioral purposes and the suitability of their cognitive levels, and that the good purpose is considered a good observable and measurable behavioral purpose (Living, 838) (2) Table: This table shows:
3. UNTRANSLATED_CONTENT_START|||
 (2) |||UNTRANSLATED_CONTENT_END|||
 Distribution of behavioral objectives to academic content

| No. | Levels Contents Academic | Cognitive feild | | | | | | |
|--------------|--|-----------------|--------|-----------------|--------------|-------|--------------|-------|
| | | Recall | intake | applic ation | Analy sis | Graft | calend ar | Total |
| Chapter One | Evolution of the atomic concept | 6 | 10 | 6 | 4 | 3 | 4 | 33 |
| Chapter 2 | Correlation forces and geometric shapes of molecules | 10 | 18 | 15 | 15 | 5 | 4 | 67 |
| Chapter Four | Solutions | 18 | 9 | 9 | 8 | 2 | 2 | 48 |
| Total | | 34 | 37 | 30 | 27 | 10 | 10 | 148 |

4- Preparing teaching plans: -

Planning is a process of designing a preconception of what the educational situation will be, which includes choosing the methods and aspects of activity appropriate to the learning situation and the nature of the learner, and achieves the desired goals of the educational learning process "(Alian, 2010: 213).

In light of this, the researcher prepared (22) teaching plans for the control group and (22) teaching plans for the experimental group according to the (Suchman model).

Sixth: The research tool.

In order to achieve the goal of the research and its zero hypothesis and measure the effect of the mobile variable on the dependent variable (acquisition of chemical concepts), this required the preparation of a test for the research sample, which is:

1- Test of Acquisition of Chemical Concepts: -

Among the requirements of the current research, the researcher prepared a test for the acquisition of the research sample of chemical concepts according to the three acquisition processes of the concept (definition of the concept – concept excellence – application of the concept) (Druze, 1995: 14), and after analyzing the content of the chapter (I, II and IV) of the book of chemistry, we found that it includes (14) main concepts (34) secondary concepts, and the researcher prepared a test for the acquisition of concepts.

Formulation of the test instructions/ the formulation of the test instructions

Include...

A-Answer instructions.

The researcher prepared an instruction sheet for the answer that is attached to the test paper and it included information about the students (name, class, division, school), and the goal of the test is not to leave any paragraph without an answer or to choose more than one answer to the paragraph and not to write on the test paper, but to answer the test paper attached to the test.

(B) Instructions for correcting the test paragraphs.

After the researcher has formulated the concept acquisition test questions and developed the typical answers for all paragraphs of the acquisition test and then gave a score of (one) for the correct answer, and (zero) for the wrong answer, or abandoned, thus the degree of testing the substantive paragraphs for selection is from the top multiple (42) and the bottom degree (zero).

3- test validity.

The honest test "is the test that measures what is prepared to be measured" (Al-Asadi and Sund, 2014: 183 - 184). To verify the validity of the test, the following types of validity were found: -

A- Apparent honesty:

Means the general appearance of the test in terms of vocabulary, clarity and drafting, including the instructions of the test, accuracy, clarity and objectivity, and deals with the appropriateness of the test for the purpose for which it was designed (Al-Gharawi, 2007: 44).

b. Content validity/

The two dimension tests, the first of which includes academic subjects and the second educational objectives, and this is done through the extent to which the content of the test corresponds to the data of the subject and the analysis of its objectives (Hariri, 2008: 141). **Applying the test to the reconnaissance sample: It was in two stages: -**

- Phase 1: The first reconnaissance sample of the test.

In order to ensure the clarity of the test items and instructions and determine the response time that Ta tohim, the researcher applied the test to a first exploratory sample of fifth-grade scientific level (biological) students at the (Al-Farouq Preparatory School for Girls), which is affiliated with the General Directorate of Education in the Holy Governorate of Karbala, consisting of (70) students.

- Phase 2: Second Reconnaissance Sample for Testing.

The researcher applied the test on (12/1/2021) corresponding to (Wednesday) on a second exploratory sample consisting of (200) fifth grade scientific level (biological) students at the (Karbala Preparatory School for Girls) affiliated with the General Directorate of Education of the Holy Governorate of Karbala, who completed the three chapters of the fifth grade scientific level (biological) chemistry book, 7th edition, 2018.

The analysis of the test items includes the calculation of the following: -

a) Difficulty & essay factor of the items

The difficulty coefficient is meant "level of complexity faced by students when answering test paragraphs" (Al-Zamli, 2009: 368), while the ease coefficient is meant as a "ratio of students who answered incorrectly about the paragraph to the total number of students" where its value ranges between zero and one, and the lower the difficulty index, the greater the ease index (Al-Dulaimi, 2005: 84), and using the difficulty and ease coefficient of the test paragraphs, it was found that the value of the difficulty equation ranges between (0.33 – 0.65), and the value of the ease coefficient ranges between (0.35 – 0.67).

B) Coefficient of excellence for paragraphs / discrimination factor for items

It refers to the ability of the paragraph to distinguish between the grades of students of the two groups with higher and lower levels according to the characteristic measured by the test. The researcher extracted the distinctive power of the paragraphs of the test of acquiring chemical concepts by applying the equation of excellence. The paragraph that has a high degree of excellence, that is, the percentage of female students who answered correctly from the higher group is greater than the percentage of those who answered correctly from the lower group. If the paragraph ranges between (0.40 – 0.20), then it is okay to distinguish. If it is less than (0.20), the distinction is weak (Suleiman, 2012: 319). It was calculated that the coefficient of excellence for each paragraph of the test of acquiring chemical concepts, it became clear that the coefficient of excellence of the paragraphs ranged between (0.37 – 0.67) for the test paragraphs.

C) Effectiveness of false alternatives: -

It means the process of judging the validity of alternatives, by comparing the number of respondents from the upper and lower groups, and that the wrong alternative is effective when the number of female students chosen in the lower group is greater than the number of female students who chose the same alternative in the upper group. The aim of this is to obtain negative values for the wrong alternative so that the paragraph is clear and good in its formulation in front of alternatives that do not attract any of the students or a few of them. These alternatives are ineffective and it is preferable to modify or replace them. In addition, the alternatives that attract students in the upper group are deleted more than the lower group (Abu Fouda, 2012: 121).

D) Stability / reliability

- **Stability of the advantage of acquiring chemical concepts**

The stability of the test was verified by the internal test method and the equation of Chiod and Richardson 20 was used, for a sample of (100) forms randomly recorded from the second exploratory sample, and the correlation coefficient in this method reached (0.84). This value is acceptable as the test is considered fixed if the value of its stability is (0.70 – 0.90) in the general balance of correlation coefficient indicators (Abu Libdeh, 2008: 223).

Seventh: Procedures for applying the experiment

The researcher conducted the application on the research sample (experimental and control) starting from Monday (7/11/2021) to Wednesday (26/1/2022) in the first semester by four sessions per week for the two groups (experimental and control).

Eighth: Statistical means/ statistical means

- 1 .T-test 2.
2. Compensation of the difficulty factor for the substantive paragraphs.
3. Compensation for the strength of the distinction of substantive paragraphs.
4. Equalization of the effectiveness of erroneous alternatives to the paragraphs on acquiring chemical concepts.
5. Kuyder-Richardson-20 equation
- Point partial correlation coefficient
7. Size of effect

Chapter Four

Presentation and interpretation of results

Research Results: There are no statistically significant differences at the level of (0.05) between the achievement rate of the experimental group students who studied according to the Suchman model and the students of the control group who studied in the usual way in the chemistry of the fifth grade scientific level and to verify the significance of the difference between the average scores of the test of acquiring chemical concepts for the experimental and control research groups. Use the test that is for two independent samples that are equal in number and Table (3) shows this

aMean, variance, calculated and tabular T-value of the students of the two research groups in a concept acquisition test

| group | Number | arithmetic mean | standard deviation | T value | | Significance level | Freedom degree | Difference Significance |
|--------------------|--------|-----------------|--------------------|------------|---------|--------------------|----------------|-------------------------|
| | | | | Calculated | tabular | | | |
| Experimental group | 35 | 33.914 | 5.710 | 5.593 | 2 | 0.05 | 68 | Statistically D |
| Control group | 35 | 26.942 | 4.664 | | | | | |

It is clear from Table(4) that the difference is statistically significant at the level of (0.05), thus rejecting the null hypothesis and accepting the alternative, that is, there is effectiveness in the use of the Suchman model in the acquisition of chemical concepts among the students of the experimental group.

Effect Size

By calculating the size of the effect using the Suchman model in acquiring chemical concepts using a square (η^2), it was found to be equivalent to (0.315). By comparing the value with the specified criterion, it appears that the size of the effect was large, which reflects the effect of teaching using the Suchman model in improving the acquisition of chemical concepts and increasing it compared to their peers in the control group, Table (4) shows this .

The value of (t) and(η^2) and the size of the effect on the acquisition of chemical concepts

| Table T Value | Calculated T Value | Effect Size Value | Effect size |
|---------------|--------------------|-------------------|-------------|
| 2 | 5.593 | 0.315 | large |

Explanation of the results: It was found through the observation of the results of the research that there were statistically significant differences between the average scores of the experimental group that studied the Suchman model and the average scores of the control group that were studied using the usual method in the acquisition of chemical concepts, and the excellence in the average scores was in favor of the experimental group in the acquisition of chemical concepts , and this difference is due to the teaching of chemistry using the Suchman model according to practical steps and an interesting presentation and the method of implementing and applying chemical concepts and information in the chemistry of students.

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

- 1- Teaching chemistry using the Suchman model has had a greater effect on students than teaching in the usual way.
- 2- The use of the Sochman model has led to positive results in the acquisition of chemical concepts among fifth-grade scientific level (biological) students.

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

- 1 - Training teachers on how to use the Suchman model during their teaching work in their schools by taking advantage of the results of the current research, and this is done through conducting in-service training courses for teachers of chemistry for the fifth grade scientific level (biological).
- 2- Informing educational supervisors about the use of the Suchman model and confirming it when they visit the evaluation of chemistry teachers in the preparatory stage

***Proposals :** at a light consequences search Present suggest researcher Procedure Studies next :

- 1- The effectiveness of teaching using the Suchman model in the teaching of chemistry and in other variables such as formal thinking, science processes and predictive thinking in the preparatory stage.
- 2- Conducting a study similar to the current study in the subject of physics, biology and mathematics and for other stages of study such as the secondary and intermediate stages.

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