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The Effectiveness of Frayer Model on the Acquisition of the Concepts of Chemistry among 9th Grade Students in Jordan

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Abstract

The aim of this study was to determine the effectiveness of Frayer model in acquiring the concepts of chemistry in the ninth grade students in Jordan, the importance of the study appears as it emphasizes the growing interest in the process of teaching concepts and learning it, and it is the unit of building the educational material and the basic brick in the educational ladder and the basis for more advanced learning, it also seeks to detect the effect of the Frayer model in the teaching of chemical concepts may raise the attention of chemistry teachers to use it in the educational process - learning.

In this study, the researcher used the experimental approach and divided the sample into two groups, the experimental group that its students are exposed to the independent variable (Frayer model) when teaching chemistry, and the control group whose student is not exposed to the effect of the independent variable and is taught in the traditional way. And the results were statistically analyzed by the SPSS program; the following statistical treatments were used: the arithmetic mean, the standard deviation, the equation difficulty equation, the equalization of discrimination, the equation of the effectiveness of alternatives and the equation of Spearman Brown and T-test.

The results of this study showed the superiority of the female students of the experimental group which were taught using the Frayer model on female students in the control group which were taught by the conventional way of acquiring chemical concepts.

Keywords: Frayer Model, Acquisition of the Concepts of Chemistry, ninth grade students, conventional way

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Introduction

The teaching of scientific concepts is one of the objectives of teaching chemistry at present after the teaching of chemistry in the past emphasizes a lot of facts and neglect concepts that are difficult for students to learn, so it is prone to forgetfulness, they are also diverse and varied, so it is difficult to be grasped by students (Michelle, 2002) and the reason for this interest is that learning the concept provides an opportunity for students to analyze their thinking processes, helping them develop more effective strategies, teaching students to explore concepts, and exploration can achieve several educational objectives, including developing the student's ability to use the main objectives of science, which is the interpretation, control, and prediction, which facilitates the discovery of the new, and learning it, as well as the achievement of a functional standard of facts, information and events in the environment, which increases the student's ability to use these concepts in problem solving situations (Azerjawi, 1991).

The Fryer model is one of the educational models based on the main principles of structural philosophy and works to achieve cognitive goals, in this model, help students to construct concepts, generalizations and theories (Zaitoun, 2007) and can be used in the teaching of different educational materials, Frayer model is one of the results of a large project to learn and measure concepts, Fryer has been held at the University of Wisconsin in the United States of America and includes stages for concept analysis, concept learning and concept acquisition measurement (1969, Frayer) learning the concept according to that model is the result of the complex interaction between the initial cognitive processes i.e. the previous experiences of the students with the help of the teacher to introduce the definition of the concept, and to provide it with examples that belong to the concept (Frayer,1970).

Research problem

Nevertheless, we see many methods that did not take the practice of teaching concepts in our schools widely, and the lack of use of strategies, and recent teaching models may make it difficult to acquire concepts, in addition, traditional methods of teaching may not help develop students' actual skills (Anbuge, 1999) this is what the researcher has learned from the low level of student achievement in the chemistry through interviewing the researcher of some teachers in schools who are teaching this subject, where he found difficulties in teaching and studying this article, it turns out that most learners memorize the subject without understanding and their dependence on the cognitive side of the theory, as well as the use by teachers of traditional methods in the teaching of this article based on conservation and indoctrination.

Therefore, the researcher adopted in his study this stand on the fact of the causes of weakness and treatment it in this article, and the adoption of modern models that have an impact in the organization of experiences and the development of thinking and talent and potential of students on the one hand, on the other hand, the development of the ability of teachers to connect the subject with the latest trends in modern teaching, therefore, the researcher wanted to try the Fryer model to teach chemistry. This is confirmed by Salameh et al. (2009), where he attributes the low level of education of learners to teachers who rely on traditional methods such as the lectures only, which makes the learner a receiver of the information and does not employ his thinking to access the material as he receives it without any effort made from him and therefore in many cases he doesn't concentrate on the lesson and this makes him only memorizing the information (Salama et al, 2009).

And through the experience of the researcher in the field of teaching chemistry for twenty years in middle and high schools and what he found of the lack of students' understanding of chemical concepts and this may be the result of the use of teaching methods in which the teacher is the center of the educational process and poor communication in the interaction between teacher and student, despite the confirmation of recent trends in education on the role of the learner as he is the center of the process of education as it is necessary to change the teaching methods used to make the student an active individual.

Therefore, the researcher experimented two models in teaching which help to improve the level of students in teaching chemical concepts and increase its acquisition and because this model of educational models, which works to raise the interest of students and raise their cognitive motivation to them, we see from this that the problem of research is determined by the following question: The effectiveness of Frayer model on the acquisition of chemical concepts among 9th graders in Jordan.

Research importance

The researcher believes that the use of Frayer model in teaching as a tool for teaching and learning facilitates the organization of content in a meaningful functional way, which leads to positive outcomes of the learning process, and creates a framework based on the discussion between the teacher and the student, it is also used in the process of linking different parts of the model to each other and helps to develop the spirit of cooperation between teacher and student, and helps students to become more effective and efficient in the teaching process.

Acquisition of concepts is one of the factors of mental formation, it has special importance in the performance evaluation which is linked to mental activity and it is seen as a key focus through which the level of students can be determined. A number of educators have discussed the concept of acquiring concepts in different ways. Perhaps the most prominent trend in defining this concept is a link to the concept of school learning, and the concept acquisition tests were used to determine what the student has learned after he or she has been exposed to a particular type of education, after having studied a particular curriculum or received a special program (Khalidi, 2008).

Based on the above, the importance of this study stems from:

1. Increasing attention to the process of teaching concepts and learning it, and it is the unit of building educational material and basic brick in the educational ladder and the basis for more advanced learning when students knew it, they used it in their daily and school life.
2. It is applied to the upper basic stage which constitutes the cornerstone of the educational ladder, the success of learning and teaching chemistry at this stage affects the success of the subsequent educational stages.
3. It seeks to detect the effect of Frayer model in the teaching of chemical concepts may raise the attention of teachers of chemistry to use it in the educational process - learning.

Research goals

The current research aims at determining the effectiveness of Frayer model in acquiring the chemical concepts among ninth grade students in Jordan.

Search Hypothesis

There were no statistically significant differences at (α = 0.05) between the average scores of the experimental group that studied chemistry according to Frayer model and the mean scores of the students in the control group that studied through the conventional method.

Research limits

1. Spatial boundaries: Upper elementary schools in the city of Amman.
2. Human Boundaries: A random sample of the ninth grade students.
3. Time Limits: The first semester of the academic year 2018/2019.

Research terms

Effectiveness: it is defined by:

1. (Shehadeh and Al-Najjar, 2003) as "The extent to which experimental treatment can be treated as an independent variable in one of the dependent variables."
2. (Al-Amro, 2002): As "the amount of desired change that occurs as a result of experimental study procedures"

The researcher defined it procedurally: Is the effect of teaching Using the Frayer model in the dependent variable among ninth grade students.

Model: it is defined by:

1. Mayer (1989): "It is a promising educational technique based on the theories of cognitive education; the aim is to help students to form mental models of the system to be studied, which illustrates the main objectives and actions of this system.
2. Abu Jado (2007): It is a "set of procedures practiced by the teacher in the educational situation, which includes the material and the methods of delivery and treatment."

Frayer model: it is defined by:

1. Abd Albari (2011): "It is a strategy based on determining the similarities and the difference between the new concept and other concepts held by the student, in this model, different concepts are taught by following the example rule associated with concept and the example which is not associated with the concept."
2. Frayer (1970): "that the teaching of the concept is the result of the complex interaction between the initial cognitive processes, so when teaching any concept should take into account the level of students and previous experience".
3. Al-Azzawi (2012): "It is a model based on the identification of the similarities and differences between the new concept and other concepts that may be learned."

The researcher defined it procedurally as: a set of organized serialized actions by the teacher when starting to teach chemistry for the ninth grade, by defining the basic concept and then providing examples.

Concepts: it is defined by:

1. AL Bakri and Afaf (2002): "The development or mental abstraction of the traits common to a group of experiences or phenomena."
2. Abu Riach (2007): "is a group of subjects, symbols, elements or incidents that share common characteristics."

The researcher defines it procedurally: a set of terms that share a set of characteristics or features to give the same meaning.

Theoretical Background

The current circumstances, represented by the information revolution at all levels, have forced

education to keep up with these changes, which highlighted the need to find better methods of performance such as preparing teachers and creating the required capabilities for the success of the work of educational institutions, and follow the scientific method and methodology in education, and the need to solve existing problems in education and provide students with problem-solving skills. Adopt appropriate evaluation strategies, and objectively judge the achievement and mastery of the objectives. As well as setting goals accurately and clearly and choose the appropriate methods to achieve the objectives, and directing efforts to achieve the best results. All this led to the direction of strategies and models of teaching to pay attention to the student's growth and trends and make him able to meet the great challenges that illuminate his mind (Rawashdah, 1998).

Frayer model is a recent pattern in the field of education that is based on a broad and comprehensive view of all elements of the educational process and the extent to which these elements affect the results and try to control them and adjust them to reach the best results (Surakuz and Khalil, 1996).

Frayer model

Frayer, a well-known educational psychologist in the United States, she was concerned with a group of her colleagues in learning and teaching concepts, so she proposed a model for acquiring and measuring concepts, where it was conducted at the University of Wisconsin in America with a team of researchers in the Department of Educational Psychology, this model includes three phases:

1. Concept analysis 2. Teaching the Concept 3. Measurement of concept acquisition (Semin and Rasha, 2011).

Frayer model is usually used when the teacher seeks to provide a general list of important concepts contained in the module that students learn, this is done after the teacher has completed his teaching or completion of the lesson and explain it, and the teacher returns to the model several times, in order to confirm and reinforce the information provided during the explanation. The presentation of these concepts is a summary of the important unit or subject matter. (Macceca, Stephanie, 2007).

We can define the procedures of this model according to the following steps:

1) Identify key concepts of unity and their relation to other concepts associated with it.
2) To clarify the extent of agreement or disagreement between the new concepts or concepts that the students actually have.
3) To present a series of eloquent examples of the new concept.
4) Provide a set of examples about the concept and ask a set of questions to students to distinguish examples (Abdalabari, 2011).

Acquisition of concepts

There were many views on the acquisition of the concept, In this regard, Kazem (1974) pointed out that the evaluation of learning the concept includes:

1) Definition of concept.
2) The distinction between positive and negative examples of the concept (Kazem 1974).:Bounder said that it was possible to measure the acquisition of the concept by:
A. Know the name of the concept.
B. Knowledge of characteristics of the concept.
3) Distinguish between affiliated and non-affiliated examples (Sucran 1989). Deeb (1986) summarizes several methods, one or more of which can be used to infer the concept. These methods are:
a) Put the thing with a bunch of things on the basis of distinguishing between its elements.
b) Forecasting.
c) Interpretation.
d) Problem Solving (Deeb 1986).

Darwaza (1995) has shown that the method used to confirm the process of learning the concept is a question that tests the student's ability to:

1- Define of the concept in writing or word when given its name, or is asked to mention the name of the concept in writing or in a word when it gives its definition.
2- Apply the concept in good learning situations.

3- Discover the critical characteristics of an uneducated concept or derive a definition of this concept by giving the learner new examples he sees for the first time. (Darwazah, 1995).

From the previous presentation, there were views that the acquisition of the concept included:

1. Giving a definition of the concept and defining its characteristics or basic characteristics.
2. Distinguish between examples belonging to the concept and others not belonging to it.
3. Application of the concept in new educational situations.

This will be followed by the researcher in preparing the test to acquire the concepts covered in the current research.

Previous studies

Frayer's study (1970)

This study was conducted in the United States of America, The aim was to know the effect of a number of examples and to confirm the understanding of the descriptive character of the students of the fourth and sixth grades of engineering concepts, The study sample consisted of (160) students, the researcher used the experimental design, which is partially controlled by four groups (Two experimental groups and two control group) and the researcher prepared a multi-choice test and a test of the pattern of completion of blanks and each test consists of (11) paragraph and all related to learning the concept, the most prominent results are:

1. There is no statistically significant effect of increasing the number of examples from four to eight to be understood by any of the fourth and sixth graders.
2. Increasing the number of examples improved understanding of no concept examples among fourth grade students.

The Study of Nazzal (2014):

This study was conducted in the Dujail area in Iraq. This study aimed at the effect of the Frayer model on the acquisition of the concepts of measurement and evaluation among students of the teachers Training Institute, the researcher used the method of semi-experimental on a target sample of (54) students, the sample was divided into two groups, an experimental group of 27 students, and a control group of 27 students, and the results showed the superiority of the female experimental group which was taught according to the Frayer model on students in the control group which was taught by the traditional method.

The study of Sahib (2013):

The aim of the study was to investigate the effect of the Frayer model on the acquisition of physical concepts among second grade students, where the researcher used a random sample of (47) students from the second grade intermediate in the school Shaima for girls in Maysan Governorate, Iraq, the sample was divided into two groups (24 female students for the experimental group and 23 female students for the control group) to achieve the objectives of the study, the researcher prepared the test of acquisition of physical concepts, the results showed a statistically significant difference at (0.05) for the experimental group in the post-application to test the acquisition of physical concepts and this indicates the effectiveness of the Fryer model in the acquisition of physical concepts.

Methodology of the Study

Population of the study and its sample

The current research community consists of all ninth grade students for the academic year 2018/2019 in the public schools at the Directorate of Education of the Naur in Amman; the girls' secondary school was chosen as a sample for the study and was chosen in the simple random way. The students of the two groups (A and C) were selected and reached 107 students. They were selected in a simple random way, as in Table (1)

Table (1): Members of Study Sample

Group	Section	Number of female students before exclusion	Number of excluded students	Number of female students after exclusion
Experimental	(A)	58	6	52
Control	(C)	59	4	55
Total		117	10	107

The researcher was keen on the equivalence of the two groups of research statistically in some variables that may have an effect in the dependent variable. Therefore, the age of the students and their academic achievement in chemistry were calculated.

Tool of the Study

The achievement test was designed to measure the achievement of students in the acquisition of chemical concepts according to the following steps:

a. Prepare a specification table.
b. Building (58) multi-choice tests according to Bloom's classification of the levels (knowledge, comprehension, application, higher mental skills), respectively, and some of them were modified and deleted so the number of test paragraphs were (52).
c. Answer instructions: Include the name of the student, the objective of the test, the time allocated for the answer, and how to answer with an illustrative example.
d. Correction instructions: The response form was prepared for the test paragraphs. The correction was based on (one-zero), where one score was given to the correct answer and zero was given for the wrong or unanswered answer, thus becoming the final score of the test.
e. Statistical analysis of the test: The coefficient of difficulty of the paragraphs for the test was calculated and ranged between (0.30-0.85), and the calculation of the coefficient of discrimination for the test paragraphs ranged between (0.25-0.63) and the calculation of the effectiveness of the alternatives.

Validity of the tool

The researcher presented the 58 test paragraphs with a list of chemical concepts On a number of experts and specialists in chemistry and methods of teaching and for the purpose of verifying the validity of the test in terms of scientific accuracy and achieve research objectives, the researcher relied on the opinions of experts and arbitrators, in light of this, the researcher made a number of amendments to a number of test paragraphs by deletion, addition and modification until it became valid number to achieve the objectives of the research, which can achieve the objectives of the search (52) paragraph each paragraph received 85% acceptance of experts' opinions, the test paragraphs are ready to be applied to the exploratory sample and thus achieve the apparent honesty and content (Al-Batsh and Farid, 2007).

Reliability of the tool

The Half way split method was chosen to extract the coefficient of stability. The test was applied to (30) female students, the answers were divided into two halves, the first half comprising the scores of the individual paragraphs, the second half includes degrees of marital paragraphs, Pearson correlation coefficient was used to extract the coefficient of correlation between the two halves. The coefficient of correlation was (0.91) then corrected by the Spearman Brown equation and the stability coefficient was 0.93.

Study Approach

In this study, the researcher used the experimental method of partial adjustment of two groups, the experimental group whose students are exposed to the independent variable (Fryer model) when teaching chemistry, and the control group whose student is not exposed to the effect of the independent variable and is taught in the traditional way. The post-acquisition test measures the dependent variable (Acquisition of the concepts of chemistry), after two weeks, the test itself is repeated to determine the extent to which students retain the material, and Table (2) shows that.

Table (2): Experimental design adopted in the current research

Group	Independent variable	Dependent variable	Tool
Experimental	Frayer model	Acquisition of chemistry concepts	Post-test to acquire concepts and retest to retain them
Control	Traditional way		

Preparing the research requirements

1. Determining the scientific material, the researcher has identified the classes that are taught during the first semester of the academic year 2018/2019 according to the annual plan approved by the Ministry of Education.
2. In the pursuit of behavioral objectives, behavioral objectives have been formulated based on the content of the scientific material.
3. Preparation of daily plans: Daily teaching plans were prepared and presented to a group of educational professionals to express their views and their relevance to the teaching method and its association with behavioral goals. Some observations were amended at a rate of (85%) for the consensus.

Statistical treatments

The results were statistically analyzed using the SPSS program. The following statistical treatments were used: arithmetic mean, standard deviation, parity equation, differential equation, efficiency equation, Spearman Brown equation, and T-test.

The Results of the Study and its Discussion

This section includes a presentation of the results reached after the researcher collected the data by means of the study tool and presented them according to the research hypothesis.

After applying the test of acquisition of the concepts of chemistry in the ninth grade students in Jordan to the students of the experimental and control groups, After correcting the answers of the students on the test subjects, the results showed that the average score of the students in the experimental group was (27.22), while the average score of students in the control group (30.24), and to find out the significance of the statistical difference between these averages, the researcher used T-test, and the results were as in Table (3).

Table (3): Arithmetic mean, variance and T value of the two research groups

Group	N	Mean	Standard deviation	Variance	T value		Df	Sig
Experimental	52	27.22	6.18	38.19	Calculated	Tabulated	53	statistically
Control	55	30.24	5.33	28.41	3.92	2.11		significant at ($\alpha = 0.05$)

The table shows that the calculated T value is greater than the tabular value, which means that there are statistically significant differences at ($\alpha = 0.05$) between the results of the two research groups in favor of the experimental group.

The superiority of the students of the experimental group, which studied the Fryer model, the students of the control group who studied the traditional method of acquiring chemical concepts is explained by using this model. This result is consistent with some previous studies on Frayer model (Nazzal, 2014) and (Saheb, 2013) and this may be attributed to:

1. The use of Frayer model in teaching stimulated student motivation towards learning and increased their focus during class.
2. Frayer model fit chemistry and the subjects covered in the study.
3. The use of Frayer's teaching model links public and private concepts, which prepares students for continuing education.
4. The use of Frayer model in the teaching process enhanced self-confidence and increased the ability of students to acquire the skill of deduction.

Recommendations

Depending on the results of this research, the researcher recommends the following:

1. To benefit from Frayer model in teaching chemistry for its obvious effect in acquiring chemical concepts and increasing academic achievement.
2. Conducting workshops for teachers of chemistry on how to apply Frayer model in teaching.
3. Encourage teachers to stay away from traditional teaching methods.
4. Conducting further studies to identify the effect of Frayer's model on non-scientific literature.

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