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The Effect of Cognitive Modeling Strategy in chemistry achievement for students

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Abstract

The aim of the current research is to verify the effect of the cognitive modeling strategy on the achievement of the chemistry course for the students of the first intermediate grade. To achieve the objective of the research, the null hypothesis was formulated via cognitive modeling strategy. The results showed that the experimental group's students performed better than the students in the control group. In the light of the results, the researchers concluded: The impact of the cognitive modeling strategy in the achievement of students of first intermediate grade in chemistry.

Keywords: Cognitive Modeling Strategy, Achievement, Intermediate.

El efecto de la estrategia de modelado cognitivo en el logro de química para estudiantes

Resumen

El objetivo de la investigación actual es verificar el efecto de la estrategia de modelado cognitivo en el logro del curso de química para los estudiantes de primer grado intermedio. Para lograr el objetivo de la investigación, la hipótesis nula se formuló mediante una estrategia de modelado cognitivo. Los resultados mostraron que los estudiantes del grupo experimental obtuvieron mejores resultados que los estudiantes del grupo de control. A la luz de los resultados, los investigadores concluyeron: El impacto de la estrategia de modelado cognitivo en el rendimiento de los estudiantes de primer grado intermedio en química.

Palabras clave: Estrategia de modelado cognitivo, Logro, Intermedio.

1. INTRODUCTION

The use of the strategy of cognitive modeling in the classroom environment aims to provide the learner conceptual models in the structure of the brain by dealing with the logic of reason and justification, as this helps to activate the left side of the brain by responding to logic and the organization of paths of thinking and transition in the process of learning from the part to all, especially in the formation of an image or a comprehensive model of the pattern of problem-solving. And to allow the learner to express his ideas and intellectual steps in solving the problem and trying to assess the solutions of others and address them on the basis of objectivity and

scientific (Abdelwahab, 2005). The strategy of cognitive modeling revolves around the re-presentation of the real situation and its composition with emphasis on clarifying the processes that revolve in this position, a number of philosophers believe that most learning situations in humans are formed by observing others and then imitating them. When a person learns a new behavior by observation alone, this Learning most likely is knowledge learning. Learning must involve internal cognitive processes, as the behavioral school has not provided a complete explanation for learning because it ignores the role of cognitive processes, which are key determinants of learning (Khafaji, 2011).

The preparation comes at the forefront of the strategy of cognitive modeling in terms of clarifying the goal and linking the lesson to be presented with the previous experience and warning of errors that learner may fall in. The next step, is the modeling by the teacher, where the teacher's role is as a model, that can be followed by students to solve a certain problem or to absorb a particular concept or to perform an educational task, that is, the teacher shows his behavior in the practice of thinking process through verbal expressions received aloud to express what is in his mind. Modeling by student is the third step, where the student plays the role of the model after preparing and training as the teacher did, but in another chemical problem, or discussing a subject expressed in a clear voice, or may made an experiment or drawing a particular shape with the illustration, while providing possible ways to solve quoted from (Alabadi, 2006). The student then compares his thinking processes to the processes he has

absorbed from the teacher. The student becomes aware of the processes of thinking, and how to activate their creativity (Obaid, 2009). And based on previous studies, learning by example is one of the most successful and most effective methods of learning, especially when accompanied by clarifications and instructions provided by the model, and it reflects the importance of presenting the types of intelligent behavior desired, in front of the eyes and ears of the learner.

1.1. Research problem

The problem of research was represented by the presence of a weakness in the strategies and methods used in the teaching of chemistry which were observed by the two researchers through their experience of the reality of teaching in secondary schools during the practical application of fourth grade students in the College of Education for Pure Science / Ibn Al Haitham as faculty members in the college, As well as that any strategies and methods of modern teaching contribute effectively to the success and development of teaching chemistry because it contains many concepts, which are difficult to understand if presented in an abstract way, and hence the need for the research emerged, and based on the above the problem of research can be identified by the following question: - (What is the effect of the strategy of cognitive modeling in the achievement of chemistry for students of first intermediate grade)?

1.2. Research importance

There is no doubt that the current period is characterized by increasing scientific knowledge, as well as, the rapid cultural changes and the revolution of globalization have been reflected on the educational institutions, which has imposed a new reality of scientific education to keep pace with those changes, moreover deepening and teaching of science in the stages of public education so as to contribute in preparing capable people to follow scientific thinking, and adapt to different life situations, the strategies and methods of teaching are an important component of the curriculum, they are closely linked to the goals and the content. They also have a significant impact on the selection of educational activities that should be adopted in teaching science as contributing significantly to the achievement of the objectives of teaching science, but it defines the role of both the teacher and the learner in the educational process (Abdelalsalam, 2001), and the natural sciences is one of the most prominent natural sciences influential in the progress of countries and prosperity, for example, chemistry is due to, a lot of scientific progress, which contributed to the interpretation of many natural phenomena. It is regrettable to see a decline in the level of achievement of our students and difficulties in understanding and assimilating this course. Hence the importance of research comes as follows:

- 1 - An attempt to implement the strategy of developed cognitive modeling, generally in science and especially chemistry, for students of first intermediate grade.

2 - To make an advantage for researchers and pave the way for them to use the strategy of cognitive modeling at other stages of study.

3 - An attempt to provide the chemistry teachers with training courses in order to use cognitive modeling.

1.3. Research Objective

The aim of the research is to investigate the effect of the cognitive modeling strategy on the achievement of the chemistry course for the students of first intermediate grade.

1.4. Research Hypothesis

For the purpose of verifying the objectives of the research, the following null hypothesis was formulated: There was no statistically significant difference at (0.05) between the average score of the chemistry achievement test for students of first intermediate grade between the research's two groups due to the cognitive modeling strategy.

1.5. Limits of research

The research is determined by:

1 -Students of the first intermediate grade in one of the governmental day schools, of the general directorate of education in Baghdad / Karkh II.

2 - The last three chapters of their curriculum (Principles of Chemistry for the first intermediate grade) adopted for the year (2009-2010), the second edition.

3. The second semester of the academic year (2015-2016).

1.6. Terminology

The strategy: Khawaldeh (2003): (A set of practical measures taken by the teacher in the light of principles and hypotheses in line with the structure of the educational material and the needs of students to achieve the intended educational goals at a specific time)).
Procedural definition: - An organized plan that includes a set of procedures, methods of teaching and techniques, planned by the researchers in a sequential manner, to achieve the objectives of the lesson content, and measured by the achievement test.
Cognitive modeling: (Holliday, 2001): "The process of forming a mental

perception of the relationships between objects, phenomena or events uses representations or forms for imitation that facilitate interpretation, explanation and prediction" (Holliday, 2001: 57).

(Obaid, 2009): ((Educational strategy to deliver knowledge to learners, in which the teacher presents to the learners ways to handle information aloud during making the involved procedures, in order to learn a particular task and focus on the most important ways of the teacher in thinking, learning and work, provided that the learners put themselves in the reference frame of the teacher)) (Obaid, 2009). Procedural definition: - A set of organized steps used by the teacher to help the students of the first intermediate grade to reach the desired goals and know their impact on their academic achievement. Achievement: It is defined by Shehata & Zainab (2003): (The amount of information or knowledge that have been obtained by the student expressed in degrees of test preparation in such a way that the specified levels, can be measured). The procedural definition: The amount of information obtained by the students of the research sample from the first intermediate grade for the last three chapters of their curriculum (energy & fuels, some Iraqi chemical industries, and chemistry in our lives) measured by the degree that they obtained in the study achievement test adopted by the researchers for this purpose (Jawdat, 2015).

2. Previous studies

1- Study of Khafaji (2011): The study aimed to identify the effectiveness of the strategy of perception above knowledge

(modeling and mutual-teaching) in the achievement of the practical performance of students in practical engineering optics and their motivation to understand the course. The study was conducted in Baghdad province in Iraq. The sample consisted of (45) students divided into three groups, two of experimental groups and the third have studied in the traditional way. The results revealed a statistically significant difference in the achievement test, practical performance and learning motivation for the benefit of the two experimental groups, which were taught using cognitive modeling and mutual-teaching.

2- Study of Alabadi (2006): The study was designed to identify the impact of the cognitive modeling strategy in the mathematical structure of students in the high school/ scientific fifth grade for a mathematics course. The study was conducted in Iraq. The sample consisted of 40 students, 20 students of the experimental group, and 20 students of the control group. The results showed that there was a statistically significant difference at the level of (0, 05) between the average of scores of the students of the experimental group that have studied using the cognitive modeling strategy and between the average of scores of the control group students that have studied in the traditional way in the test of the mathematics prepared for this study, and for the benefit of the experimental group.

3- Study of Shehata & Zineb (2003): The study aimed to identify the effect of the strategy of cognitive modeling in the

achievement and creative thinking of second intermediate grade students in chemistry. The study was conducted in Babel province in Iraq. The sample consisted of 66 students distributed in two groups, one experimental, that has studied according to cognitive modeling and, the other has studied according to the traditional method. The results of the study revealed that there is a statistically significant difference in the achievement test and creative thinking for the benefit of the experimental group which has studied using the cognitive modeling strategy.

3. Theoretical Background

Cognitive modeling strategy involves representing the factual situation with an explanation of the processes in this situation. Pandora believes that most learning situations in humans are by observing others and then imitating them. When a person learns new behavior through observation alone, this learning is likely to be cognitive learning; Therefore Pandora believes that learning must involve internal cognitive processes (Khafaji, 2011). Steps to Implement Cognitive Modeling Strategy: This strategy consists of several steps: preparation: It is fulfilled by the presentation of a problem in chemistry by the teacher in front of students, making them in the case of active thinking and that makes the student aware of the problem, and it is the definition of the problem or skill and thinking skills included, with giving examples and linking the previous information with the new

through giving brief thoughts about the lesson. Modeling by the teacher: The teacher provides a model of mental processes involved, in solving a chemical problem by presenting more than one solution to the problem, loudly during the solution and clarify what in his mind and how to overcome the problem, as he solves it for the first time. Modeling by the student: The student plays the role of the model after preparing and training as the teacher did, but in another chemical problem, or discussing a subject expressed in a clear voice, or may be made an experimenter drawing a particular shape with the illustration while providing possible ways to solve.

The student then compares his thinking processes to the processes he has absorbed from the teacher. The student becomes aware of the processes of thinking, and how to activate their creativity (Obaid, 2009). Teacher participation with the student: In this step, the student takes the role of the model, the teacher acts as the mentor and provides the feedback to clarify any mistake or misunderstanding of the student in order to avoid making a mistake. Receiving the student's responses: In this step, the teacher receives the students' responses and helps them discover the results of their learning, which makes them know the relationships and the reason between their choices, their work and the results achieved. Evaluation: In this step, the teacher evaluates students' performance by asking them to explain the methods they have used during the solution, how the solution was reached or to discuss these solutions (Dulaimi & Adnan, 2005).

3.1. Search procedures

To achieve the objectives and hypotheses of the research, the researchers followed the following procedures:

3.1.1. Choose the experimental design

Because the current research contains an independent variable, which is the cognitive modeling strategy and a dependent variable, which is the achievement, the partial experimental design (experimental group and control group) has been chosen, with the post-test and as shown in the table below:

Table1. The table of the experimental design for the research

The Group	Parity	Independent Variable	Dependent Variable
experimental Group	(parental achievement, age by months, intelligence, and the semesters score in chemistry	Cognitive Modeling Strategy	Post-achievement test
control Group			

3.1.2. Identifying and choosing the research community

The research community consists of the intermediate and secondary day schools of the directorate of education Baghdad / Karkh II, for the academic year (2015-2016).

3.2. The research sample

The study sample was selected from the students of the first intermediate grade in the intermediate school of Obaqah bin Nafi for boys of the directorate of education Baghdad / Karkh II. The school consists of six sections (A, B, C, D, E and F) for first intermediate grade, randomly (C) section has been chosen to represent the experimental group with (34) students, and (d) to represent the control group with (35) students.

3.2.1. Preparation of research requirements

The last three chapters of their curriculum (energy & fuels, some Iraqi chemical industries, and chemistry in our lives)) adopted for the year (2009-2010), the second edition. The cognitive behavioral objectives were then determined and have been formulated based on the content of the scientific material covered by the experiment, its number reached (165) behavioral objectives classified according to the first three levels of Bloom's classification (remembering, absorption, and application). The study plans for each of the two research's groups for the three chapters included in the experiment were prepared. A sample of these plans was presented to a group of experts and specialists in the methods of teaching science and chemistry.

3.2.2. Search Tool

The two researchers built an achievement test in chemistry for the first intermediate grade of the three chapters (energy fuels, some Iraqi chemical industries, and chemistry in our lives) according to the content of the specific scientific course and the behavioral purposes of the levels of (remembering, absorption and application) and according to the following stages: The objective of the test was to measure the academic achievement in the chemical information of the research's sample students. The researchers then determined the scientific course in the three chapters included in the experiment from the book of principles of chemistry for the first intermediate grade for the year 2010. The number of paragraphs of the test have been determined, where a number of professors in methods of teaching science, measurement, evaluation and psychology, have been participated to determine the number of paragraphs, that can be included in the test achievement, to be suitable for the level of students of the first intermediate grade and more appropriate in the time and more comprehensive for behavioral purposes and the content of the study course, they have agreed that (40) paragraph are suitable for testing.

3.2.3. Preparation of the specifications table (the test map)

The table of specifications means the detailed outline that shows the value of the content of the course in the form of main headings,

with specifying the relative weight of each subject, the percentage of objectives and the number of questions assigned to each party, therefore, the researchers prepared the specifications table for the three chapters in the book, which have included in the experiment and behavioral purposes, the weight and the relative importance of each chapter based on the number of pages have been calculated.

3.2.4. Determining the type of the test paragraphs and its instructions

A specific number of behavioral purposes was selected according to the levels of behavioral objectives, and for each purpose, an objective test was formulated. Forty (40) thematic paragraphs were selected, As studies indicate that this type of tests is the best of the objective tests, because it measures mental goals that are difficult to other tests to evaluate it, as well as, the test instructions for students has been formulated by putting a sheet of instructions attached to the achievement test paper, as for the instructions for correcting the test, the researchers developed a model to answer each question, , a score (one) has given for the correct answer and a score (zero) for the wrong answer, the paragraphs that left or have more than one answer, have been treated as the wrong answer, that is, the total score of the substantive paragraphs were determined by the range from (0 - 40) score.

3.3. Test Validity

Two kinds of validity have been achieved, virtual validity and validity of the content as follows:

Virtual validity: The test of achievement and behavioral purposes has been displayed on a number of experts in the methods of teaching science, the views of experts and suggestions have been taken in consideration, with the amendment to some paragraphs, (80%) agreed on the validity of the test scores and their suitability to the students' level and the specific behavioral objectives. The test is therefore valid. The validity of the content: This is intended as a logical analysis of the paragraphs of the scale and its items that are representative of the parts of the content of the course. The validity of the content of the test has been verified by specifying its paragraphs according to the specification table, which is an indicator of the validity of the content of the test and thus the test is valid in terms of virtual validity and validity of content.

3.3.1. The application of the first exploratory test

The test was applied to an exploratory group, not from the sample of the researches; this group consists of 20 students. It was found that the instructions for the answer and the test paragraphs were clear and the average time was 50 minutes.

3.3.2. The application of the second exploratory test (Statistical analysis of test paragraphs)

The test was re-applied to another sample of students, out of the research sample from Khalid Bin Al Waleed Boys School of the Directorate of Baghdad- Rusafa the first. The students' answers were corrected and the grades were ranked descending, then 27% has been chosen for the highest and 27% for the lowest, to represent the two different groups and the following were calculated: Difficulty and easiness coefficients of the paragraphs: The difficulty equation was applied for each paragraph of the test. It was between 0.70 and 0.47. The test paragraphs are considered acceptable if ranging from 0.75 to 0.20. The power of the distinction of paragraphs Alajili (2001) indicates that the paragraph that its distinct power increases from (0.20) and above is considered a good one (Alajili, 2001). The distinction power of the test ranged from 0.67 to 0.26, indicating that all paragraphs were distinct. The effectiveness of the wrong alternatives: By applying the equation for the effectiveness of the wrong alternatives, it was found that the alternatives attracted more of the students of the lower group compared to the students of the higher group, based on that, it was decided to keep the alternatives as they are without change.

Stability of the test: The researchers adopted the Alpha Cronbach equation for the test and the calculated stability coefficient in this equation reached (0.88) which is evidence of the stability of the test and thus the test is ready for final application. Procedures for

applying the experiment: The experiment was applied according to the following steps:

1 - Coordination with the school administration to organize the schedule of weekly lessons.

2 - Before starting of teaching the two groups of research by the teacher of the course with the supervision and guidance of researchers, parity has been made between the two groups.

3 - The experiment was applied by actually teaching the students of the sample of the study at the school of Aqaba bin Nafifor boys on 25/2/2016), by (2) lessons per week for each of the research's two groups and for a full semester for the year 2015-2016 and ended on 1/5/2016.

4 - After the application of the experiment, the search tool (test of achievement) was applied to the research groups (experimental and control) on 28/4/2016.

The experiment was applied as the following:

A - The experimental group: The students of the first intermediate grade (C) in the school of Aqaba bin Nafifor boys, who have been studied using the strategy of cognitive modeling.

B - Control group: formed of students of the first intermediate grade section (d) at the school of Aqaba bin Nafifor boys who have been studied using the usual method.

4. RESULTS VIEW (ANALYZING AND INTERPRETING)

In order to ensure that the research objective is achieved, the following null hypothesis will be tested: - There is no statistically significant difference on the level of (0.05) between the average of the score of the chemistry test for the first intermediate grade students' between the two research groups due to the cognitive modeling strategy. In order to test the validity of the null hypothesis, the arithmetical mean and the standard deviation of the score of the students of the experimental and control groups were found in the achievement test, and by using T-test of two independent and unequal samples, the calculated T value was found as shown in the table below.

Table 2. The arithmetic mean table, the standard deviation and the calculated T value of the experimental and control group scores in the achievement test

The Group	Number	Arithmetic average	Standard Deviation	Degree of Freedom	T-Value		The level of significance (0.05)
					Calculated	Tabular	
Experimental Group	34	87.34	4.90	67	3.364	2	Significant for the experimental group
Control Group	35	28.31	6.27				

It is clear from the previous table that the calculated T value was 3.364, which is greater than the table value of (2.) at the level of significance (0.05) and the degree of freedom (67). Therefore, the null hypothesis is rejected

5. DISCUSSION

The results showed that the experimental group was superior to the control group, who has been learned according to the strategy of cognitive modeling, on the control group, who has been learned in the usual way in the of chemistry as shown in the table above, the results are consistent with the study of (Khairullah, 2013), which showed the high academic achievement has come as a result of the use of this strategy, and the researchers of this paper believe that the reasons for the superiority of students or the success of the strategy are due to:

- 1 - The strategy of cognitive modeling is more effective than the usual methods of academic achievement, due to the fact that the strategy works to activate the discussions between the students themselves or between the teacher and the student in each group, which led to increase absorption of the scientific material.
2. Provide an active, vivid and learning-centered environment that helps students interact with different chemical topics.

3 - The strategy of cognitive modeling is based on collaborative learning, which is characterized by collective participation and exchange of information from one group or between groups, which helps in the process of linking the previous and current information.

6. CONCLUSIONS

In light of the results of the research, researchers can conclude the following:

The impact of the cognitive modeling strategy in the achievement of first-grade students with chemical information.

7. RECOMMENDATIONS

In light of the results, the researchers recommend the following:

1 - Employ the strategy of cognitive modeling as a model in teaching in secondary education.

2. Include cooperative activities in a chemistry book and organize its content to help improve cognitive achievement.

8. PROPOSALS

In order to complete the research, the researchers propose the following:

- 1- Conducting other studies on study stages and other similar subjects.

- 2 - Conduct another study to compare the effectiveness of teaching cognitive modeling and another model.

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