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Psychology behind Employing the Kolb Model in Teaching Mathematics and Its Effect on Achievement among Second Grade Students

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Abstract:

The research was conducted in Iraq and aimed to identify the effect of teaching mathematics in the Kolb model in the achievement of students of the second grade average , the research sample reached 40 students of the second grade average divided equally into two groups randomly selected to represent group (A) The experimental group who studied in the Kolb model and group (B) who studied its students in the normal way, and an achievement test was prepared in mathematics consisting of 20 items of the multiple choice type and its apparent validity and content were verified, as well as the calculation of reliability in the way of Koder Richardson 20, amounting to 0.79 .Using the T-test of two independent samples, the research hypothesis was tested and the results showed the superiority of the experimental group students over the students of the control group in the achievement of mathematics, which indicates the effectiveness of teaching mathematics according to the Kolb model. In light of this result, a set of recommendations were made, including : The teachers of mathematics should pay attention to diversity in the provision of scientific material through the stages of the Kolb model, which begins with the sensory excitement of the student through which their auditory and visual senses stimulate the subject of the lesson and move to stimulate observation and attention to realize the relationship between the elements of the mathematical situation before them and link them to the reality of the student and give him the opportunity to apply and exchange views with his fellow students by forming groups to practice educational activities that motivate them and help them to understand, absorb and experiment. To complement this research, the researchers submitted proposals for future research, including a study of the effect of the Kolb model for teaching mathematics in acquiring concepts and developing mathematical cohesion in middle second graders.

Keywords: Kolb Model, Teaching Mathematics, Professionalism, intellectual curiosity, energy level, self-monitoring, Achievement.

The problem of research: Mathematics is characterized by sequential synthetic medicine. From its axioms, results and theories are derived and constructed by sequential walking in interrelated evidentiary steps, which is characterized by abstraction. Therefore, the attention of educators is focused on learning in the first place and not on education. This has led to a change in the function of the teacher and the methods of teaching that focus on how the student teaches himself. (Baker, 202270:)

Because of the nature of mathematics, those who study mathematics need a level of awareness of the concepts, rules and basic ideas of mathematical topics, as well as the follow-up and use of diverse intellectual processes, and any deficiency in this will be directly reflected in the low levels of student achievement.

It is no secret that mathematics teachers, supervisors and even parents suffer from difficulties in absorbing mathematics, especially in the middle stage, where many mathematical labels and processes are pumped. This is what the researcher diagnosed through their work in teaching this subject for more than 15years and confirmed by the results of previous local studies as in a study and study(Jassem, 2022),and a study (Al-Waeli, 2021),and others.

The reason for this is probably that most of the methods used in the teaching do not focus on the nature of mathematics and the style of students in their learning, but usually focus on providing the material by the

teacher with specific participations of the learning and give him sufficient opportunities to participate within the classroom and this led to the lack of motivation and enthusiasm for the lesson anddivert their attention from the task required of them, which reduces his academic performance and affect his academic achievement and will remain an obstacle to the occurrence of effective learning.

In order to search for ways to develop the methods of teaching mathematics, it was found that teaching through the learning methods of students improves their attitudes towards study and improves their cognitive performance, as indicated by many specialists who are Dun (1983) and (Abbas, 201729:). Thus, the current research will seek to use a teaching strategy at transitional stages so that the learning methods of students take into account the Kolb model of teaching middle second grade mathematics and perhaps this will help to improve their academic achievement.
The research problem can be framed by the following question: -

What is the effect of employing the Kolb model in teaching mathematics and its effect on achievement and reducing mental curfew among second grade students?
The importance of research: In the light of the tremendous scientific and cognitive changes witnessed by the contemporary world, especially the progress in the areas that witness the expansion of knowledge, information and technology, the world has become a small village thanks to modern means of communication, which contributed to the transfer of information and exchange of experiences, and to learn about the cultures of other societies and influence and be affected by them, which created a prevailing impression among educators and educators indicating the need for a thorough review of various educational and pedagogical strategies. Focusing on the principles, strategies and methods of education has become a necessary and urgent case for developing student assistance on a basis that helps him how to learn? What methods does he learn? As well as learning ways of thinking that correspond to recent environmental developments and developments that take into account the individual differences of students. (Attia,2008 :19)

One of the subjects that had much interest in reviewing its curricula and teaching methods is mathematics, which is the basis of knowledge, and an important element in the development of various natural, biological and social sciences. There is no field in this era or the foreseeable future that does not depend on mathematics, which enabled man to reach civilizational achievements, as it changed the face of life throughout history and as the scientist Newton said that it is "the queen of science and its servant ", which is the language of science and a ruling element in what is currently taking place and what is expected in the future.

(Al-Kubaisi and Abdullah , 2015: 11)

Teaching mathematics is one of the basic components of the curriculum because the educational objectives and the content chosen by the specialists in the curriculum can only be evaluated by the teacher and the methods that he follows in his teaching. Therefore, teaching can be counted as a link between the student and the components of the curriculum and method as it includes the educational situations that take place within the classroom and organized by the teacher and the method that he follows so as to make these attitudes effective and interesting at the same time. Modern trends in mathematics education and learning have not been one of their main objectives. The students' preservation of information, as is the case in traditional curricula and teaching methods, but rather the change of attention to active learning and providing students with scientific skills and trends that enable them to discover information and form the correct scientific concepts themselves by providing a learning environment and appropriate conditions for their students to deal with life situations. (Abdulsalam, 2006: 9)

According to Dahabi(2004), students differ in their abilities to learn, and vary in their methods towards addressing the multiple daily life problems, and this was a reason for the growing interest in taking into account individual differences between them and dealing with them on the basis of their learning patterns, and those responsible for the educational process and learning methods emphasize the need to pay attention to the development of teaching methods that take into account this difference to practice mental processes that help them understand and assimilate. (Gold, 2004 :1-2)

In light of this, there are many educational models related to the teaching and learning styles of learners, and the search for learning methods was not only necessary to reveal their preferences for these

methods, but to search for teaching methods that suit these differences in order to develop their abilities to be able to follow the rapid developments to deal with the different life variables facing them ,and in light of this, multiple models and methods appeared such as the (Young, McCarthy, Schmeck, Dunn, Dunn, Herman, Julay, and Kolb) model. (Abdelazim and Fattah, 201727:)

Kolb found that individual differences in learning styles are a combination of genetics with acquired life experiences and environmental factors. Such patterns are reinforced in individuals through interaction and social communication processes within the family, school and work environment. In order for learning to be effective and achieve its goals to obtain good results in the cognitive, emotional and skill aspects, students' learning methods must be taken into account and teaching methods that are compatible with those methods should be chosen as much as possible. (Olayan, 202035:)

It is not limited to talking about the importance of teaching strategies and their effect on the educational process, but should be addressed about what they aspire to the educational process of using those strategies, which is academic achievement, which is important in the field of education as one of its important goals, which is the graduation of a generation with good academic achievement, as it represents the outcome of what the student learns after a certain period of time. From that, it is possible to know the success of the strategies designed and planned by the teacher and the achievement will be translated into grades that the student obtains. (Saadi, 2020 :17).Thus, academic achievement is an indicatorof the student's success in school life and the ability to interact and coexist with others in the future. (Al-Shayeb, 2017: 34)

Based on the above, the importance of the current research can be summarized in the following points:

1. It sheds light on the importance of mathematics, especially for middle school students, which is the basis from which the student will start to complete his high school and beyond .
2. This research is in line with recent trends that call for the use of modern models, strategies and methods in teaching and learning compatible with individual differences, including the Kolb model.

3. Provide researchers and graduate students with the results of the current research to benefit from conducting similar or complementary research.

Research Limits: This research is limited to:

1. Human Boundaries: - Second Intermediate Grade Students
2. Spatial boundaries: - Secondary and middle day schools affiliated with the General Directorate of Education of Kirkuk Governorate.
3. Objective limits: - grade (first , second, third , fourth) of the mathematics textbook scheduled for the academic year (2021) fourth edition. (Jassim et al., 2021)

- Kolb's methods (divergent, absorptive, convergent, adaptive)

o Research Objective: The research aims to employ the Kolb model in teaching mathematics and to identify its effect on the achievement of middle second grade students.

In light of this goal, the following **null hypothesis** was formulated**:** There is no statistically significant difference at the significance level ($0.05 \propto \leq$) between the mean math achievement scores of the experimental group students who studied according to the Kolb model and the control group students who studied according to the usual method.

Terminology:

The researchers define the **teaching strategy in the Kolb method procedurally as:** the set of successive steps that the teacher used in teaching mathematics to middle second grade students (the experimental group) according to the steps of the Kolb model gradually by stimulating the sensory experience of the student and providing educational situations to conduct a reflective observation of him and move from them to identify concepts and abstract them by giving a definition or coding them and then confirming their acquisition through effective experimentation with his colleagues and applying in different situations that help him to link to his life reality and acquire new concepts to develop his previous experience and are in accordance with their specific learning methods in four

ways, namely convergence, divergence, absorptive and adaptive.
The researchers also define **procedural achievement as**: Thedegree achieved by the second-grade student average level of success achieved, or reaches as a result of acquiring experiences, concepts and procedures in mathematics during the first semester. (Saadi, 202017:)

Previous studies: The researchers reviewed a number of previous studies related to the employment of the Kolb model of teaching and found that it was effective in many dependent variables, whether they were cognitive such as achievement and different types of thinking, skill or affectivity, including :

The **Jaradat study (2011)** was conducted in Jordan, and aimed to identify the effect of the use of education based on the Kolb model in developing students' creative thinking skills. The research sample consisted of (120) male and female students (60). As an experimental group, they studied in the Kolb model (60) method for the female officer. They studied in a regular way from high school students. The researcher prepared a test of creative thinking skills consisting of (50) items of the multiple choice type, and the results of the study reached a statistically significant difference in favor of the students of the experimental group.

Rasmy study (2014) was conducted in Iraq, and aimed to identify the effect of a strategy for teaching physics according to the Kolb model in the achievement of second-graders average and their logical intelligence . The research sample consisted of (60) students who were divided into two groups (30) students as an experimental group who studied in a Kolb model method and the other (30) students as a control group who studied in a regular way. The researcher prepared an achievement test consisting of (40) multiple choice test items and a logical intelligence test consisting of (35) items .

The results of the study concluded that there is a statistically significant difference in the average academic achievement scores between the students of the experimental group and the students of the control group and for the benefit of the students of the experimental group.

- Search Procedures:

First: Selecting the experimental design: The researchers adopted the experimental design of the two experimental and control groups with a post-test for achievement because it suits this research and achieves its objectives .

Second: Selection of the research sample: The Alton Bridge Boys High School was chosen to carry out the research experiment**. The** reason **is** that one of the researchers is a teacher in the same school, which will facilitate the application of the experiment with flexibility and non-disclosure of his status.

In a simple random way, a division was selected as an experimental group and a division B as a control group, and the failed students were excluded to exclude their previous experience factor, so that the number of members of the research sample was 20 students in each group.

Third: Equivalence of research groups: The researchers were keen on statistical equivalence in variables that are believed to affect the course of the experiment and its control, namely:age in months , academic achievement of mathematics in the first middle grade for the students of the research sample for the academic year (2021-2022) as well as the degree of intelligence.The arithmetic mean and standard deviation of each of the previous variables were extracted and the T-value of two independent samples of each of the previous variables were calculated and the results were included in the following table:

Table (1) Results of equivalence procedures between the two research groups

variable	Group	No.	Mean	STD Deviation	F	Sig	o	Df	Sig

Age	**Experimental group**	**20**	**165.6500**	**11.29637**	**2.032**	**0.162**	**0.460**	**38**	**0.648**
	Control group	**20**	**164.2500**	**7.57333**					
Mathematics	**Experimental group**	**20**	**66.1500**	**11.91759**	**0.075**	**0.786**	**464**	**38**	**$645.**
	Control group	**20**	**64.3000**	**13.26690**					
	Control group	**20**	**46.6000**	**13.41405**					
IQ score:	**Experimental group**	**20**	**28.4500**	**3.54631**	**0.001**	**970**	**0.600**	**38**	**.552**
	Control group	**20**	**27.7500**	**3.82340**					

It is clear that all the significant values ((Sig) are greater than the level of significance (0.05), this means that there is no statistically significant difference between the means of the research sample in these variables, and thus the two groups are equivalent.

Fourth: Research requirements: To achieve the goal ofthe research and its hypothesis requires the preparation of a number of requirements:

A) **Identification of the scientific material (content)** The scientific material was specified in chapters (I – II – III – IV) of the textbook of mathematics for the second middle grade (Jassim et al., 2017) .

B) Formulation of Behavioral Purposes: Researchers (212) formulated a behavioral purpose of Bloom's classification of the first three levels (remember, understand , apply). This is 22% , 40% and 38%, respectively.

C) Preparation of teaching plans: A teaching plan was prepared for the experimental group according to the Kolb model and its steps as follows:

Giving the introduction of the lesson and then presenting the subject in the following stages: Employing the sensory experience of the students by presenting the subject of the lesson supported by explanatory means. It was a drawing or a hologram or a conceptual chart according to the nature of the subject. Here, the teacher emphasizes the reflective observation of the parts of the tangible presentation so that the student can then move to the stage of formulating abstract concepts such as definitions or formulating principles and laws and mentioning the steps of the solution and so on. Then, activity papers are given that students of groups divided in advance according to the specific learning style of each of them (which was measured through the Kolb scale of learning methods) and they are given the opportunity to experiment effectively and the teacher tries to bring the concepts closer and link mathematics to the reality of life for them and give them new concepts to develop their information.

A model of a teaching plan was also organized according to the steps of the usual method, and the two models were presented to a number of arbitrators, to indicate their views on them and the extent of matching the offer with the teaching steps according to the strategy designed for the experimental group and the usual method of the control group and its suitability for behavioral purposes, and the amendments were made in the light of their views. The rest of the teaching plans were prepared according to the modified models; the number of (50) plans for each group, and thus the plans are ready for implementation.

Fifth: Preparing achievement test: The researchers prepared an achievement test in mathematics for the second intermediate grade, starting with defining its objective and specifying the number of its items, which amounted to 20 test items of the MCQ test, distributed according to the table of specifications, which includes two dimensions, the percentage of achievement of behavioral objectives and the percentage of students who have learned lessons for each chapter, then it's face validity was verified and content were verified by presenting it to a group of arbitrators in the field of educational and psychological sciences. The test items were approved with an approval rate of more than 80% of their opinions.

The test was applied in its initial form to an exploratory sample of second grade students with an average of (100)students, then the difficulty factor for the items was calculated as well as the coefficient of discrimination, and it was found that all items are within the acceptable ratios.

Then the reliability of the achievement test was verified using the Coder Richardson equation 20 and amounted to 0.79 and this is a good reliability coefficient and thus the achievement test is ready to apply to the research sample.His total degree was (20)degrees .

Sixth: Application of the experiment:

The actual teaching experience started on 19/10/2022. One of the researchers studied the students of the two research groups according to the teaching plans prepared for each group. The teaching continued until 31/12/2023.
C. The researchers applied the achievement test on (4/1/2023).

IX. Statistical means: Researchers used the following statistical means:

A) T-test for two independent samples: for the purpose of the equivalence procedures of the two groups, and to verify the research hypothesis.
B) Coder-Richardson equation 20 for computing the achievement test reliability coefficient.
Presentation and discussion of the results: To verify the hypothesis of the research according to the researcher and the arithmetic mean and the standard deviation of the scores of the students of the experimental and control research groups in the achievement test and then applied the T-test for two independent samples and the results were included in Table (2) below:

Table (2)Results of the T-test for the average scores of the experimental and control groups in the achievement test

Group	No.	Arithmetic mean	Standard Deviation	Integration.		No. Calculated	Sig.	Effect size	
				Quiz Levine.	Sig			ETA square η2	large
Experimental group	20	14.85	2.833	0.029	.867	3.165	0.003	0.21	
Control group	20	12.05	2.762						

The above table shows that the value of the moral function (sig) of the fibrin homogeneity test is greater than 0.05, which means that the two groups are homogeneous. It was also found that the sig of the T-test amounted to (0.003), which is less than the moral value of (0.05), thus rejecting the first zero hypothesis. This means that there is a statistically significant difference between the average scores of the experimental and control groups

in the achievement test, and for the benefit of the students of the experimental group, and the size of the effect left by teaching students was calculated according to Kolb's model of mathematics and it turned out that it is a large size in its effect on the achievement of their answers to his test. This finding is consistent with the Jaradat study **(**2011**)** and the Rasmi study (2014) in that the adoption of the Kolb model in teaching affects student achievement. The researcher attributes this to the fact that the students of the experimental group who studied the topics of mathematics in the light of this strategy received a continuum of learning methods that were applied in the experiment through observation and observation and then the students learned the abstract concepts and practical experimentation, and make their own decisions, and that this result is consistent with the vision of "Kolb" that learning occurs by perceiving information that begins with sensory experiences, contemplative observation, abstract concepts and effective experimentation, which affected the students' understanding of the study material and improved their academic achievement.

Conclusions: The researchers concluded that :

1. Employing the Kolb model in teaching mathematics led to raising the academic achievement of the experimental group students, which relied on exploration, observation, active learning of abstract concepts, and sensory experiences compared to the usual method for the control group students who received the material in the traditional teacher-centered way.

2. The effectiveness of teaching the strategy according to the "Kolb " model by setting the objectives of the teaching plan and dividing students into groups to pose mathematical problems and collectively search for alternatives to solutions and choose the most appropriate ones, and then ask questions and inquiries about topics that are ambiguous, and this led to an increase in the level of academic achievement of students.

Recommendations: In light of the results of the research, the researcher directed the following recommendations to:

1**. Teachers of mathematics**:Interest in diversity in the provision of scientific material through the stages of the Kolb model, which begins with the sensory excitement of the student through which stimulates his auditory and visual senses of the subject of the lesson and move to arouse observation and attention to realize the relationship between the elements of the mathematical situation before him and link them to the reality of the student and give him the opportunity to apply and exchange views with his fellow students through the formation of groups to practice educational activities that motivate them and help them to understand, absorb and experiment.

2. Preparation and training unit in the General Directorate of Education: Holding training courses for teachers of mathematics on teaching according to the Kolb model, as well as training them on how to attract the attention of students and the mechanism of communication with them during the lesson .

Suggestions:To complement the results of the current research, the researcher proposes to conduct the following studies:

1- The effect of Kolb's model for teaching mathematics on the acquisition of concepts and the development of mathematical cohesion among middle second grade students.
2- Employing the Kolb model in teaching mathematics and its effect on achievement and developing their supracognitive thinking among fifth grade scientific students.

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