

Research Article

The effectiveness of an educational program according to the strategies of cognitive load on student's achievement in mathematics among the fifth grade preparatory students and their academic self- efficacy

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Abstract:

The current research aim to identify the effectiveness of an educational program according to the strategies of cognitive load and its impact on the mathematics achievement of the fifth scientific students and their academic self- efficacy, and in order to achieve the objectives of the research, the researcher adopted the descriptive approach in building a an educational program and the experimental method to know the effect of program on academic self- efficacy. The research sample consisted of (44) students from fifth scientific students, and the two research tools consisted of the achievement test consisting of (40) items, and the measure of academic self-efficacy consisted of (40) items, and after process the results statistically, the results showed the superiority of the experimental group students who studied according to the educational program on students who studied according to the regular method.

Accordingly, the researcher recommends several recommendations, including:

1-The importance of mathematics teachers' interest in choosing appropriate teaching strategies that are appropriate for the academic subjects, activating the role of activities, and increasing their achievement

2- Curriculum developers must include mathematic books, especially the fifth grade, for strategies of cognitive load

The researcher suggested several proposals, including:

1-Measuring of the effect of other strategies for achievement and academic self-efficacy.

2-Studying of the effect of cognitive burden strategies with other preparatory school subjects.

THE FIRST CHAPTER

FIRST THE RESEARCH PROBLEM:

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One of the problems that counter Education, as the two researchers believe; the low level of students and low achievement in mathematics for the preparatory stage. There was a divergence of views on its causes, some of them attribute this for, the weakness of mathematics teachers experience toward modern teaching methods , hence they used traditional teaching methods, that transform the teacher into an important axis in the educational process. As for the student, his role is passive, receiving information only, and this was proven by the study of (Al Hassan, 1995: 68) Some studies have attributed the low level of academic achievement to poor learners cognitive load strategies, and this what the study indicated in (Ali and Morab 2005:72) and was supported by an Arabic study made by (Zytoon 2008) in Jordan, It concluded that the achievement rate of the basic stage students was weak and low.(Zytoon 2008: 389)

Accordingly, this research has been carried out to answer the following question:

What is the effect of the educational program in accordance with cognitive load strategies to achievement of mathematics and academic self-efficacy among students of the fifth scientific grade?

SECOND: THE IMPORTANCE OF THE RESEARCH:

Learning with its modern sense employs a wide range of teaching strategies that enables learners to access knowledge on their own. This will happen only by applying strategies that make them take responsibility for their own learning, as a result, attention has begun to be given to learning and teaching strategies, the effective role which these strategies play in improving the learning environment, fulfilling the aspirations of educationalists, learning is a fundamental process in an individual's life and we must choose appropriate and adequate strategies in classroom education situation in an accelerated era in all areas, particularly at the cognitive and technical approach. (al hashmey and Taha 2008,29).

Self-competence, which plays a prominent role in the formation of students' beliefs about their ability to perform certain levels of performance, whether they are verbal or not, in addition, it is important to roll-out students and their ability to perform the mental and cognitive processes of learning. Pajeears (Pajeears 1997) stressed out that, learners with high self-competence use cognitive strategies to a great extent and persevere in doing so and they continue to be determined for a long time in comparison to persons who have low self-proficiency (al Shenawyee 2006:473).

THIRD: RESEARCH OBJECTIVES AND ASSUMPTION:

- 1- Current research aims at: Building an educational program based on the cognitive load strategies for teaching mathematics, and its impact on the achievement and academic self-proficiency of fifth-level students.
- 2- There is no statistically significant difference at the level of 0.05 between the average grades of the students of the experimental group who study mathematics in the educational program according to the cognitive load strategies and the average grades of the students of the control group who study the same subject in the usual way of achievement.

FORTH: RESEARCH LIMITS:

The current search is determined as follows:

- 1- Fifth-grade science in secondary and preparatory day schools for boys' in the Second Karkh Education Directorate for the academic year (2020-2021).
- 2- Math Book Scheduled for Fifth Grade Science, authored by a committee from the Ministry of Education, 8, 2017. Chapter I (logarithms) to Chapter VI (derivatives).

FIFTH: DEFINITION OF TERMS:

1- Educational program:

- (Saad, 2006) said that: "an information system and practical educational activities operating under specific conditions and instructions containing content, activities and elements to be presented in an accurate scientific manner and teaching and evaluation methods in accordance with the objectives of the program, taking into account the needs and characteristics of the learners." (Saad, 2006: 3)

- Procedural definition: "The activity and experience of female researchers in accordance with the cognitive load strategies for teaching mathematics to students of the experimental group of the research sample."

2- THE STRATEGY

- Abu Shareekh (2010): "A plan that describes the actions taken by the teacher and the learner, in order to achieve the desired learning outcomes, and teaching strategies are based primarily on learning models and theories."

Abu Shareekh (2010 : 8)

- Procedural definition: an organized plan that includes a set of procedures, teaching methods, and methods, planned by the researcher in a sequential manner, and taught by the students of the experimental group from the research sample throughout the duration of the research experiment, to achieve the set goals.

3- Cognitive load :

(Al feel, 2015): "The total mental energy consumed by the learner during the process of dealing with the subject of learning or solving a problem or performing a particular task. This mental energy varies from subject to subject and from learner to another." (Al Feel, 2015, 93)

Operational definition: A set of procedures that the researcher follows with the students of the fifth scientific grade through the stages of the educational program to reduce the mental effort of their working memory and distractions through the use of appropriate educational strategies and the identification of educational activities and aids.

3-Educational Attainment

- (AL derman, 2007): proving capability of delivering the acquired educational experiences for which it was developed. (AL derman ,2007 :101)

- Procedural Definition: the achievement that the Mathematics research sample students delivered, (the subject of the research experience) measured by the grades they obtain after answering the remote achievement Test prepared by the researcher.

Academic Self-efficiency:

- (Jacob, 2012): "the student's beliefs about his capabilities of organizing and delivering works, procedures required for achieving positive results in his studies". (Jacob, 2012, 83)

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- Procedural Definition: it is the total degree that the student receives after answering the paragraphs of the academic self-efficiency scale prepared for the purposes of the current research.

Second Chapter

First Axis: Theoretical Framework

Educational Program:

- The design origins of the educational learning process are back to Psychology and Pedagogy researches, especially the studies related to learning theories, although educational design mainly derives from those theories. However, educational design seeks the best educational methods that lead to achieving deliverables. The significance of educational design resides in the fact that it is the bridge between the theoretical and applied Sciences. (Trick, 1999: 29).
- The educational program is one of educational design outputs, which is a set of strategies, activities, experiences and academic knowledge planned and organized to achieve the educational process objectives in the best way possible. (Al Ghariri, 2003: 18).

Phases of Creating an educational program :

- A-planning phase that involves (analysis and design).
- B. program implementation phase (application)
- V-Calendar phase that involves (introductory calendar, structural calendar and final calendar).

Cognitive Load Theory:

John Sweller developed the cognitive load theory, which is one of the cognitive theories, learning and education theories as well. It belongs to the information processing theory, and addresses its most significant outputs, especially what relates to memory and its types. Working Memory that attends and processes it into only visual and audible elements with a limited capacity that can hold information temporarily, which is the reason behind poor education. This requires developing strategies to address it, the thing that Sweller did in the mid-1980s. Long-term memory is the one that stores information and knowledge processed and the skills learned by Human, and its capacity is undefined. (Al Feel, 2015: 131).

Academic Self-efficiency:

Researchers have made continuous and successive attempts to provide theoretical interpretations of the determinants, inputs and outputs of learning. One of these theoretical interpretations was what Albert Bandura (1977) came up with, which addresses with one of its concepts, the concept of self-efficacy or self-effectiveness; where individuals have a self-system that enables them to exercise a measure of control over their thoughts, feelings and actions. This system includes the ability to code, and learn from others through imitation or alternative behavior, how to develop alternative strategies that enable him to regulate his own behavior. Self-efficacy is one of the significant determinants of learning that expresses a set

of judgments that relate not only to what an individual accomplishes, but also to what he can accomplish. (Bandura, 1983:46).

Fields of Academic Self-efficiency:

(Self-confidence and believing in capabilities, perseverance and paying effort, acceptance and taking responsibility for achieving objectives, flexibility of thinking and decision-making and establishing relationships with others and effective communication).(Meteors, 2018: 451)

Second Axis: Prior Research

• **Cognitive load Strategy Schedule No. 1**

Item	Research Title	Researcher Name	Research objectives	Research Sample	Research Tools	Statistical methods	Research Results
1	The impact of a tutorial created based on the cognitive load theory on developing the critical thinking skills	Abu Jawda 2004 Jordon	Knowledge of the impact of a tutorial created based on the of cognitive load theory on developing the critical thinking skills at Mathematics.	88 students (male and female)	Test the development of dimensional critical thinking skills.	Arithmetic average. Standard deviation . T test of two independent samples.	The presence of statistically significant differences in favor of the experimental group.
2	Cognitive load and its relationship to early and late optional attention in preparatory students at Mathematics.	Hassan 2010 Iraq	Knowledge of the cognitive load and its relationship to early and late optional attention in preparatory students at Mathematics.	120 students (male and female)	Attention scale.	Arithmetic average. Standard deviation . - Percentage. - Duplicates.	Students have late optional attention
3	The effectiveness of the tutorial created based on the theory	Agag 2016 Iraq	. Knowledge of the effectiveness	16 students (primary 4)	Mathematical problem solving skill test	T test for two independent samples,	Students of the experimental group

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of the cognitive load theory for developing problem-solving skills for students who have learning difficulties.		of tutorial created based on the cognitive load theory to develop problem-solving skills for students who have with learning difficulties				Mann Whitney U test for medium samples, difficulty coefficient	outnumbered the control group ones.
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• Academic Self-efficiency Schedule No. 2

Item	Research Title	Researcher Name	Research objectives	Research Sample	Research Tools	Statistical methods	Research Results
1	The impact of the Focused Listing strategy in developing self-study efficiency for first - grade preparatory students in biology.	Abd 2016 Iraq	It aims to identify the impact of the Focused List strategy in developing self-study efficiency for preparatory first-grade students at biology.	(56) first preparatory grade students	Self-study proficiency scale	T-test test	There are significant differences between experimental and control groups
2	The effectiveness of the e-code within scientific tasks in the achievement and academic	Naser 2017 Iraq	Identifying the effectiveness of the e-code in the achievement and academic self-efficiency of second-	(60) second preparatory grade students	Academic self-proficiency scale	Spss (21) program	There are significant differences between experimental and control groups

	self- efficiency of students of the second intermedia te grade in the subject of physics		grade preparator y students at physics				
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Third Chapter

First: Research Approach

Both researchers followed descriptive approach to create an educational program in accordance with the cognitive load strategies in Mathematics for Grade 5 students, and they followed the experimental approach to identify the impact of the program in achievement Mathematics for the students of the scientific fifth grade (bio) and their academic self-efficiency.

Second: Experimental Design:

Both researchers selected the experimental design for the purposes of such research. A two groups design, experimental control with pre-test which is one of the real designs, while the educational program, which is

Based on Cognitive load strategies represents (independent variable), therefore, educational achievement and academic self-efficiency (dependent variables) the tutorial-based strategies cognitive load (variable independent).

Third: the research community:

It is represented by students of the fifth scientific grade in the public preparatory and secondary day schools for boys In the six districts of Baghdad governorate for the academic year 2020/2021, the researcher intentionally chose the General Directorate of Education in the second governorate of Baghdad / Karkh.

Fourth: The research sample:

The number of preparatory & secondary day schools for boys in Al-Karkh district / 2, (50) schools, and the sampling random method was followed to choose Al-Hakim Preparatory School for Boys.

Fifth: The search tool:

- 1- The achievement test: select the test items (40) items.
- 2- Academic self-efficacy scale: select the items of the scale (40) items.

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Sixth: Statistical means: The SPSS statistical package was used

Fourth chapter : the results:

The first hypothesis:

The results showed that there is a difference between the mean scores of the experimental group students and the average scores of the control group. By using the t-test for two independent samples, the significance of this difference was tested, and it is clear from Table (3) that the calculated t-value (3.96) is greater than the tabular t-value (2) at the significance level (0.05) and the degree of freedom (58), which means the students' superiority of the experimental group who study using the educational program on their colleagues in the control group who study in the traditional way

Table (3) The mean, standard deviation, and the calculated and tabular T-value of the achievement scores of the two research groups

Group	Sample	Mean	Slandered deviation	Value of calculated t	Value of tubular t	Significant level (0.05)
Experimental	22	37,5	5.41	3.96	2	significant
Control	22	27,6	5.07			

The second hypothesis:

the results showed that there is a difference between the mean scores of the experimental group students and the average scores of the control group, and by using the T-test for two independent samples, the significance of this difference was tested. It is clear from Table (4) that the calculated t-value (3.26) is greater than the tabulated t-value (2) at the significance level (0.05) and the degree of freedom (58), and therefore the second null hypothesis is rejected, and this means the superiority of the experimental group students who study using the educational program On their colleagues in the control group who study with the traditional method in the measure of academic self-efficacy.

Table (4) the mean, standard deviation, and t-value of the academic self-efficacy scale for the two research groups

Group	Sample	Mean	Slandered deviation	Value of calculated t	Value of tubular t	Significant level (0.05)
Experimental	22	140.4	15.77	3.26	2	significant
Control	22	126.7	21.75			

Interpretation of the results:

Through the results of the current research, which showed the superiority of the experimental group students who studied mathematics according to the educational program which was prepared according to the cognitive loading strategies on the students of the control group who studied the same subject in the usual way in the achievement test, and academic self-efficacy, and this is due to:

- 1- The program contains a wide range of activities, giving students experience and confidence in carrying out their duties, and thus increasing their knowledge and achievement.
- 2- The cognitive load strategies helped to link the previous knowledge existing in the cognitive structure of the students with the new learned knowledge in a meaningful way.
- 3- Teaching according to cognitive loading strategies seems to have developed an equal feeling among the students in the experimental group, by raising their academic self-efficacy, by asking exciting questions for that.

Recommendations:

1. The necessity for mathematics teachers to be interested in choosing teaching strategies that fit the study subjects, activating the role of activities and increasing their achievement.
2. The necessity of including mathematics books, especially the fifth grade science, on strategies of the cognitive load by curriculum developers.

Proposal :

- 1- Measuring the effectiveness of other strategies for the cognitive load in achievement and academic self-efficacy. 2- Studying the effectiveness of cognitive load strategies in other subjects in the preparatory stage

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