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Research Article

The impact of an educational-learning program based on cognitive load strategies on holistic thinking among fifth-grade science preparatorystudents

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Abstract:

The current research aims to realize theimpact of an educational-learning program based on cognitive load strategies on holistic thinking among fifth-grade science students, and to reach the research objectives, the researcher adopted the descriptive approach in creatingan educational-learning program and the experimental method to know the impact of the program on holistic thinking. The research sample consisted of (44) students from fifth-grade science students, and the research tool consisted of the holistic thinking test consisting of (30) items, and after treating the results statistically, the results showed the superiority of the experimental group students who studied according to the learning program, it is for 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 subjects, activating the role of activities, and developing holistic thinking.

2-The necessity of including mathematic books, especially the fifth-grade, for strategies of the cognitive load by curriculum developers.

The researcher suggested several proposals, including :

1-Measuring the effect of other strategies for achievement and thinking.

2-Studythe effect of cognitive load strategies with other preparatory school subjects.

The impact of an educational-learning program based on cognitive load strategies on holistic thinking among fifth-grade science preparatorystudents

Chapter (1)

First: Research problem

The information revolution had many implications, one of them wasputtingeducation in front ofa major challenge and responsibility.Arab conference held in Cairo, 2002,confirmed the existence of general concern about low education and declining quality of itin Arab countries. And attributed thisto the educational content thatis not related to the lives and abilities of learners, the rigid and traditional teaching methods that focus on memorization and retrieval not on understanding and creativity. (Kojk et al., 2008: 13)

The researchers sought to diagnose the problem locally. They reviewed many studies that addressed the reality of teaching generally and the preparatory school, in particular, as it is the level that the research will discuss. The study of (Al Faili, 2014), through which teaching methods used by mathematics teachers in preparatory school reformed, confirmed that mathematics teacherslack diversity in teaching methods, also they lack educational attitudes that develop thinking patterns byactivating methods that emphasize the learner role in the classroom educational attitude.The study also found that the teachers don't respect the individual differences of the learners because oftheir lack ofusing examples, their lack of diversity of the levels of questions, and teaching methods and techniques. (Al Faili, 2014: 64)

Therefore, this study made to answer the following question:

What is the impact of an educational-learning program based on cognitive load strategies on holistic thinking among fifth-grade science students?

Second: Research importance:

Developing the mental capacity of the student became one of the main objectives of educationamid the technological revolution, like the ability to observe, realize relationships, inference, simulation, and independent thinking, also preparing a scientifically educated citizen able to manage his life responsibly and preparing qualified personnel of scientists, engineers, and teachers to be able to face the challenges of 21st century full of scientific inquiries, where every citizen needs to use the scientific information; to make his daily decisions, and to have the ability to participate and discuss in public debates, and significant issuesrelated to science and technology. (Ali, 2007: 20)

The importance of thinking in the life of the learner cannot be denied. The interest in thinking is as old as humanity, as it has always required the use of the mind to adapt to the environment that posed great challenges over time, and it is considered one of the concepts that appeared in the last twenty years, which received the attention of psychologists and researchers because it is one of the factors influencing on the education (Debono, 1984: 49). Since the beginning of the second half of the 20th century, psychology was marked by a growing interest in cognitive processes to the extent to say that the current age is the age of interest in the psychology of thinking. (Qatami, 2001: 12)

Third: Research objectives and premise:

The current research aims to create an educational program based on the cognitive load strategies to teach mathematics and identify its impact on the holistic thinking of fifth-grade science students.

There is no statistically significant difference at the level (0.05) between the average scores of the experimental group students who study mathematics using the educational program based on the cognitive load and the average scores of the control group students who study the same subject using the usual way in the holistic thinking test.

Forth: Research limit

The current research limited by:

1- fifth-grade science students in secondary and preparatory day schools for boysaffiliated to the Second Karkh Education Directoratefor the academic year 2020-2021 AD.
2- Mathematics textbook of the fifth-grade science, written by a committee from the Ministry of Education, 8th edition, 2017AD., from the first chapter (Logarithms) to the sixth chapter (Derivatives).

Fifth: Terms identifying

1- Educational program:
- Saad, 2006: An information systemand practical educational activitieswork under specific conditions and instructions that include content, activities, elements that are presented in an accurate scientific manner, teaching and assessment methodsaccording to the objectives of the program, keeping in mind learners needs and characteristics. (Saad, 2006: 3)
- Operational Definition: The activities and experiences that the researcher employs according to the cognitiveload strategies for teaching mathematicsto the experimental group students of the research sample.

2- The strategy:

Abu Shareekh, 2010: A plan describing the actions of the teacher and the learner to achieve the desired learning outcomes. Teaching strategies are based primarily on learning models and theories. (Abu Shareekh, 2010: 8)
- Operational Definition: An organized plan that includes a set of procedures, teaching methods, andpractices, which the researcher prepared in sequence, and in which the students of the experimental groupfrom the research sample studythroughout the research experiment, to achieve the set objectives.

3- Cognitive load:
- Al-Fil, 2015: the total mental effort takesby the learner to addressing a learning topic, solving a problem, or performing a specific task. This mental effort varies from one topic to another and from one learner to another. (Al-Fil, 2015, 93)
- Operational Definition:A set of procedures that the researcher takes withthe fifth-grade science students through the stages of the educational program to reduce the mental effort of theirmemoryand distractions by usingappropriate educational strategies and identifying the educational strategies and means.

4- Holistic thinking:

- Sternberg, 1993:The individual's preferred method of dealing with problems holistically, through which the individual can organize his thoughts and employ his abilitiesinkeeping withthe tasks and situationshe encounters without going into details. (Sternberg, 1993: 120)
- Operational Definition:the sum of the answers to the questions of the fifth-gradebiology students (research sample) measured by the total score received in the holistic thinking test that prepared for the mentioned purpose.

Chapter (2)

First theme: Conceptual framework

The origin of design in the educational learning processgoes back to the researches made in the fields of psychology and education, especially studiesthat addressed learning theories. Even thoughinstructional design derives mainly from those theories, the instructional design looking for the best educational methods that reach the desired objectives. The importance of instructional designlies in that it is the bridge between theoretical and practical science. (Al Hila, 1999: 29)

The educational program is one of the outcomes of instructional design.It is a set of planned and organized strategies, activities, experiences, and academic knowledge to achieve the objectives of the educational process in the best way. (Ghurairy, 2003: 18)

- **Cognitive load theory:**

  John Sweller laid the foundation stone for the cognitiveload theory. It is one of the cognitive theories and one of the theories of education and learning, as it belonged to the information processing theory. It addresses the most important things presented by information processing theory, in particular,that related to memory and its types.Working memory is that pays attention to information and processes it into auditory and visual components only, and is characterized by a limited time in which information is stored. This limitation is the underlying cause of weak education or teaching , which requires providing strategies to address it, and this is what Soiler did in the mid-eighties.

Long-term memory stores information and knowledge that processed, and skills learned by the individual. Its capacity is unlimited. (Al-Fil, 2015: 131)

- **The concept of learning according to Cognitive load theory:**

  Learning is the process of storing knowledge and skills in long-term memory in a way that learners can recall and apply them when needed.The theoristsof the cognitive load believe that they canaddress traditional learning. Cooper stated that providing simple content that includes a few cognitive elements makes the student able to understand the text.He recommended staying away from including content with high levels of interaction because this leads to ineffective learning due toincreasedcognitive load on the memory. He also recommended staying awayas

much as possible from the cognitive increase in information that would weaken the learning.This theory suggested that the limitation of short-term memory (working memory) is the main responsible for the storage process. When the learner wants to store any information, it must be processed in the working memory, and if this memory, under any circumstance, is unable to store the information, then the learning fails, requiringdesigningthe educational subjects in keeping with these limitations. (Abu Riach, 2007: 202)

- **Holistic thinking:**
  Holistic thinking is a comprehensive and balanced ability that developed the individual's ability and enhances self-awareness and social awareness to realize that he is part of a world in which different issues are intertwined (Al-Fallu, 2005, 10).We find that holistic thinking is a subject of concern to researchers in different countries and that the interest in it at the research and theorizing levelstartedwhen the American Association for Humanistic Psychology (AHP)adopted holistic thinking. Since then, this association has worked on making tests to develop holistic thinking, as well as there were joint researches between Georgia State University and the Russian Academy of Educationaimed atencouraging students and teachers in differentcommunitiesto develop holistic thinking. The study made by Ruopp, 1992,included 200 students,it aimed to recognize the relationship between holistic thinking and the psychology of communication. The study found a positive result that there is a relationship between holistic thinking and the psychology of communication (Ruopp, 1993,P.12). So, we find that the qualities that characterize the holistic-thinking individual are the desire to work with the group, stay away from individual actions, and tendency to generalities.(Robbins, 2005, P.13)

Second theme: Previous studies

- **Cognitive load theory**

Table (1)

No.	Study title	Researcher name	Study objectives	Study sample	Study tools	Statistical methods	Study findings
1	Cognitive load and its relation to early and late selective attentionamong preparatory mathematics students.	Hassan, 2010, Iraq	Recognize the cognitive load and its relation to early and late selective attention among preparatory mathematics students.	120 female and male students	Attention scale	Arithmetic average. Standard deviation. Percentage. Repetitions.	The students have a late selective attention
2	The effectiveness of an educational program based	Ajaj, 2016, Iraq	Recognize The effectiveness of an educational program based	16 fourth-grade primary students	Mathematical problem-solving skills	Two independent T-test. Mann-	The experimental group students

	on the cognitive load theory for developing problem-solving skills for people with learning disorders		on the cognitive load theory for developing problem-solving skills for people with learning disorders			Whitney- U Test for mediumsamples. Difficulty factor.	outperformed the control group students.

- **Holistic thinking**

Table (2)

No.	Study title	Researcher name	Study objectives	Study sample	Study tools	Statistical methods	Study findings
1	Flow and its relation to self-regulation and holistic thinking pattern among university students	Jawad, 2015, Iraq	Aims to recognize Flow and its relation to self-regulation and holistic thinking pattern among university students	400 university students	Holistic thinking patter n. Self-regulation	(Spss) Pearson correlation coefficient	There is a positive relationship between flow and holistic thinking
2	The impact of PECS strategy (P.E.C.S)in the attainmentsof chemistry and holistic thinking among fifth-grade science female students	Ibrahimi, 2002, Iraq	Aims to recognize the impact of	71 fifth-grade science female students	Holistic thinking scale Attainments test	(Spss) Pearson correlation coefficient	There is a statistically significant difference between the average scores of the experimental group in holistic thinking.

Chapter (3)

First: research approach:

The two researchers adopted the descriptive approach to creating the educational program according tothe cognitive load strategies in mathematics for fifth-grade science. They also adoptedthe experimental approach to defining the effect of the program on the attainmentsof mathematics among fifth-grade science (biology) and their holistic thinking.

Second: Experimental design:

The researchers chose the experimental design for this research, which includes experimental and control groupsand a post-test. It is one of the real designs, as it represents the educational program based on the strategies of cognitive load (independent variable) and holistic thinking (dependent variable).

Third: Research population:

The population of this research is the fifth-grade science students in secondary and preparatory day schools for boys affiliated to the six Education Directorates of Baghdad governorate for the academic year 2020-2021.the researcher deliberately chosethe General Directorate of Education in the Baghdad Governorate,Second Karkh.

Forth: Research sample:

The number of secondary and preparatory day schools for boysin the Directorate of Second Karkhwas (50). The simple random method was adopted to choose Al-Hakim Prep for Boys.

Fifth: Research tool:

Holistic thinking test: 30 items

Sixth: Statistical methods:

1- SPSSstatistical package.
2- Pearson correlation coefficient.

(chapter 4)

Presentation of the results:

The results showed that there was a difference between the means of degrees of the experimental group students and the that of the control group, by using the T-test for two independent samples, the significance of this difference was tested.

It is clear from Table (3) that the calculated t-value (85.2) is greater than the tabulated t-value (2) at the significance level (0.05) and the degree of freedom (58), Accordingly, the second null hypothesis is rejected, which means that the students of the experimental group who study using the educational program outperform their colleagues in the control group who study in the traditional way in the holistic thinking test.

Table (3) The arithmetic mean, standard deviation and T-value of the holistic thinking test for the two research groups

Group	sample	**arithmetic mean**	**standard deviation**	the calculated t-value	the tabulated t-value	Significance level (0,05)
Expermintal	**22**	7,34	71,3	85,2	**2**	Significance
Control	**22**	4,27	47,**3**			

Interpretation of the results:

1- The content of the program contributed to the practice of higher mental processes, which allowed the students to invest their mental energies and their ability to organize their knowledge and to apply what they learned in new situations, thus increasing the level of thinking and awareness of their educational situations.

2- The use of cognitive load strategies helped students in stimulating a deeper level of thinking , and motivates them to think correctly and keeps them away from deaf memorization of information

Recommendations:

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

Proposals :

1- Measure the effectiveness of other strategies of cognitive load in achievement and thinking
2- Investigate the effectiveness of cognitive load strategies with other subjects in the preparatory stage.

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