

Instructional-learning design according to interactive electronic mind maps and its impact on generative thinking skills of fifth scientific grade students in biology

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Abstract:

The current research aims to;

1-Preparing an educational design according to the interactive electronic mind maps for the fifth scientific grade students in biology.

2-Recognize the effectiveness of the instructional design according to the interactive electronic mind maps in;

A. Generative thinking for the fifth scientific grade student

To achieve the research objective, the following null hypothesis was formulated;

There is no statistically significant difference at the significance level (0.05) between the average scores of the experimental group students who studied according to the educational design of interactive electronic mind maps and the average scores of the control group who studied according to the usual method in the test of generative thinking.

In order to verify the validity of this hypothesis, the researcher adopted a partially controlled experimental design for the experimental and control groups, with a post test for generative thinking, as the experimental group studied according to the educational design prepared according to the electronic mental map program (I Mind Map10), while the control group studied according to the ordinary method, the research community is represented by the students of the fifth scientific grade, all of whom are enrolled in Al-Etidal Secondary School for Girls, one of the government day schools affiliated to the General Directorate of education Resafa/1, for the academic year (2021-2022) AD, which were chosen intentionally, and the research sample consisted of two divisions (A, B) to represent the experimental and control groups, respectively, with (31) female students for the experimental group and (32) female students for the control group, and the researcher rewarded the two groups with a number of variables as (chronological age, intelligence, previous information, generative thinking test), the instructional-learning design was built according to four stages (analysis, design, implementation, evaluation), the researcher prepared her research tool, represented by the generative thinking test. Generative thinking test in its final form consists of (18) paragraphs that measure six of the skills of generative thinking (fluency, flexibility, hypothesis, prediction, detection of errors and fallacies, representation). The apparent validity and construct validity were calculated for the items of the scale and the discriminatory power. As for the stability of the test, it was calculated using the alpha-Cronbach equation, which amounted to (0.87), the application of the experiment took one semester (2021-2022) and the researcher taught the two research groups by herself, and at the end of the experiment analyzed the results statistically by using the statistical bag (SPSS-23) and the (Microsoft Excel) program, and the t-test for two equal independent samples. The results showed that the students of the experimental group outperformed the students of the control group in the test of generative thinking, and thus the null hypothesis was rejected, from these results, the researcher concluded that the educational design based on interactive electronic mind maps had a positive impact on improving their level of generative thinking. In light of this, the researcher reached a number of conclusions, including:

The effectiveness of the instructional-learning design in raising the achievement of fifth scientific grade students .

2-The possibility of adopting the prepared the instructional-learning design according to the electronic mental maps program (I Mind Map 10) by biology teachers.

The researchers also reached a number of recommendations and suggestions related to the research results.

Chapter One

First, the research problem

The need to carry out such a study emerged due to the lack of studies that use giving lessons assisted by electronic programs in general and also because of the tremendous development in the field of technology in various areas of life. In our time, the need for distance teaching has been embodied by electronic programs, especially the conditions we live in under COVID 19 pandemic, which has led to the emergence of the urgent need to apply modern technologies on the ground, especially in the field of education, and most countries have tended to encourage educational institutions to integrate technology into education.

After the researchers were reviewed on the reality of teaching biology for the fifth scientific grade (biology) through continuous communication with many teaching cadres for the preparatory stage, the researcher noticed that the teaching of biology depends on the usual traditional methods and modern methods are rarely used, and that there is a low level of students, according to the opinion of those who were surveyed, a questionnaire in those schools about student achievement and the teaching methods they use, it was found that 70% of teachers are not satisfied with the achievement of their students.

Therefore, through the previous indicators, the researcher felt that there was a problem represented in the low generative thinking of the fifth scientific grade (biology) students, which led to the desire to experiment with modern teaching methods represented by the interactive mental electronic maps for teaching biology for the fifth scientific grade (biology), and then it can be determined the research problem with the following question;

What is the effect of the instructional-learning design according to the interactive electronic mind maps on the generative thinking of the fifth scientific grade (biology) female students in the subject of biology?

Through the foregoing, the importance of the current research can be summarized in the following points;

1-Teaching students on electronic mental maps helps learners to find creative solutions and strengthen memory.

2-Draw attention to the effectiveness of interactive electronic mind maps using the I Mind Map10 program in teaching

3-The current research within the limits of the researcher's knowledge is the first locally that deals with the instructional-learning design in interactive electronic mind maps that are in line with modern trends in teaching and generative thinking in biology.

The research provides a test that measures students' abilities in generative thinking skills, which benefits postgraduate students and teachers in preparing tests.

Third: Search objective

The current research aims to achieve the following;

1-Preparing instructional-learning design according to the interactive electronic mind maps for the students of the fifth scientific grade in the subject of biology.

2-Knowing the effectiveness of instructional-learning design according to the interactive electronic mind maps in generative thinking skills for the fifth scientific grade students.

Fourth: the research hypothesis

1-There is no statistically significant difference at the level of significance (0.05) between the average scores of the experimental group students who studied according to the instructional-learning design of interactive electronic mental maps and the average scores of the control group who studied according to the usual method in the test of generative thinking skills.

Fifth: search limits

1-Students of the fifth scientific grade at Al-Etidal Secondary School for Girls affiliated to the Education Directorate of Resafa /1 in Baghdad

.-The first semester of the academic year (2021-2022) AD2

.-The textbook for biology3

Sixth: Defining terms

3- Educational Design: defined by

(Al-Arabi and others, 2015) that

"A comprehensive system that contains training, learning and teaching related to the educational material, and its general objectives are related to the course, through which content, various teaching aids, methods, teacher's guide and final evaluation are selected, and the content is tested on students." (Al-Arabi et al , 2015: 45)

It is procedurally defined as a systematic process according to specific steps to organize the content of the biology book for the fifth scientific grade , according to the program used for interactive electronic mind maps consisting of analysis, design, implementation and evaluation.

.-Interactive electronic mind maps were defined by2

- **(Al-Maliki, 2019) as;**

It represents an organized graphic form of information based on a computer program that stimulates thinking and helps to remember, in an interesting style that combines images, colors and words." (Al-Maliki, 2019: 72)

It is procedurally defined as (interactive electronic mind maps that are drawn using the I Mind Map10 program, so that the information contained in the syllabus is organized into an interesting artistic image that includes images and colors and stimulates thinking and remembering the material faster, and video or audio texts are included to facilitate the educational process)

; **-Generative thinking was defined by4**

- **(Entwist, 2000) that**

One of the outcomes of deep learning is the ability of students to generate answers when they do not have a ready solution to a problem, especially when it is an unfamiliar problem that does not fall under the facts they have previously learned.) Entwist,2000:14(

It is procedurally defined as: a set of skills that allow students to generate information and creative ideas based on the pre-knowledge available to them, and the ability to set hypotheses to solve a specific problem, predict in the light of the data, and detect errors and fallacies and representation, and it is measured by the degree that the students will obtain in the test of the generative thinking skills prepared by the researcher.

Chapter Two

Theoretical background and previous studies

First, instructional-learning design

Multiple studies have shown that instructional design, when it is to be effective, should consider the characteristics of learners, as the individual differences of learners are very important in teaching and learning, and the possible reason for the low level of achievement for learners is the mismatch of learning characteristics with the design of materials and educational practices, and therefore it will be very important to consider learners' needs when organizing content and methods that increase the likelihood of learners' learning objectives achieved. (Zheng and Smaldion,2003,153)

After the researchers reviewed a number of models of instructional-learning designs and how to build them, it became clear to them that there are different opinions in the construction process, but most of the designs agree on a number of basic stages that are consistent with the stages of the current research, which are as follows;

- Analysis phase1
- The stage of preparation (design2
- The implementation phase3
- Evaluation stage4

Second: Interactive electronic mind maps

It is the ultimate organizational thinking tool, and it is the easiest way to enter information into the brain and then retrieve this stored information, and an effective and creative way to take notes, all mind maps have many things in common, including: they all use colors, and they have one natural structure, as it begins with a center from which the lines branch of it and thus resembles the shape of a nerve cell, and also all mental maps use lines, symbols, and words in addition to imaginary graphics, and this transforms notes and summaries into an organized, colorful and memorable chart that works appropriately and similarly to how the brain works (Buzan, 2002:221)

Interactive electronic mind mapping steps

- 1-Open the application program after downloading and installing it on the computer.
- 2-Choose the appropriate template for the mind map from the templates on the application or program.
- 3-Create the main idea by inserting a picture expressing the subject of the map next to writing its texts.
- 4-Determine the number of map branches that make up the content of the main idea and start creating it by pressing the icon on both sides of the main idea and dragging in the appropriate direction.
- 5-Writing texts on the main branches with the ability to add (images, drawings, video, text files and shapes on these branches)
- 6-Creating the sub-branches came out of the main branches and adding (images, graphics, video and text files) to them, and this is also done on the smaller terminal ends, if any, until reaching the least branching.
- 7-The ability to add an audio clip, so that the written text is pronounced during its presentation and moving it in a color that supports its pronunciation of sounds.
- 8-The possibility of changing the colors and shapes of all components of the map according to what the designer wants.
- 9-The possibility of changing the background of the mental map by choosing the color that matches the theme of the map.

10-The possibility of coordination between the components of the map in terms of size, location, and color, and the possibility of making visual connections between two or more elements with each other to clarify the relationship between them.

11-The possibility of adjusting the time and manner of Display information on a mind map before outputting it.

.12-Sending the mind map in the form of an image, video, flash file, PDF, WEB file, or other formats that the program allows.

13-Sending the mind map and save it as a designer, which allows the possibility of modification by deletion, addition or change with complete ease. (Hassan, 2019: p. 265-266)(Buzan, 2010, p. 355-360)

The researcher used (I Mind Map10) program in designing interactive electronic mind maps in her study for the following reasons;

endorsed by Buzan, the inventor of mind maps

- It is the only program

It is highly flexible in design.-

- It creates an atmosphere of fun, excitement and suspense for students.

- The program allocates illustrations, fonts, colors and backgrounds .

- The possibility of modification at any time on the prepared maps and the possibility of including symbols, drawings or real images stored on the computer or through the Internet..

- The possibility of presenting prepared maps through presentations.

- Easily sending it as an image or a pdf file.

Third: Generative thinking skills

It is defined as a mental activity that makes the thinking process take place in an open format, in which production is characterized by a unique feature, which is the diversity of produced answers that do not specify them for the available information. (Al-Titi, 2004: 51)

The importance of generative thinking in science teaching

1-The development of metacognitive thinking among learners and this is the result of generating ideas for them.

2- Increasing the learner's ability to understand and comprehend, and generating new ideas that address ambiguous concepts and alternative perceptions by finding logical relationships to build knowledge in the learner's cognitive structure.

3-Creating new experiences for the learner to enable him to overcome the problems he encounters while learning the sciences.

4-The learner becomes able to continuously generate ideas and invent solutions, and stop adopting traditional and familiar solutions.

5-Enhancing learners' decision-making and criticism skills. (Al-Wadiya, 2019: 30-31)

Generative thinking skills includes

(Fluency, flexibility, hypothesis imposition, prediction, expansion, recognizing errors and fallacies).

Chapter Three

Research Procedures

First: Research Methodology: This chapter includes the procedures carried out by the researcher, starting with building the instructional-learning design and its validity for

application, as well as preparing the research tool and the statistical methods used in analyzing its results in this research, which are explained in detail as follows;

Second: Experimental Design: The experimental design with partial control was chosen for the experimental and control groups, as shown in Scheme (1)

Group	Equivalence	Independent variable	Dependent variable
Experimental	Chronological age	The instructional-learning design according to the interactive electronic mind map program I Mind Map 10	Generative thinking
Controlled	Previous information Generative thinking	Usual way	

Third; Research community and sample

A research community represented by the fifth scientific grade students (biology), all of whom were enrolled in Al-Etidal Secondary School for Girls, one of the government day schools affiliated to the Directorate for Education of Rusafa /1, for the academic year (2021-2022) AD, totaling 67 students divided into two divisions. This school was intentionally chosen from between preparatory and secondary schools in the center of Baghdad governorate of the General Directorate of Education Rusafa /1.

Fourth: Control procedures

A- Internal safety of the experimental design

To verify the internal integrity of the experimental design, the following factors were addressed;

Equivalence of the two search groups-

Setting up the search tool

Building a test of generative thinking skills

One of the research requirements is to build a test for generative thinking for the students of the two research groups, so it was prepared.

The first survey application

After verifying the validity of the test, it was applied for the first time on a sample consisting of (30) female students from the fifth scientific grade students in the Central Preparatory School for Girls on Thursday 4/11/2021, in order to know the extent of the clarity of the test instructions as well as the clarity of its paragraphs, and researcher supervised on the application and clarifying some paragraphs for the students, so all the paragraphs became clear and understandable in terms of meaning and wording.

The second exploratory application

The test was applied to a second exploratory sample after investigating the clarity of its paragraphs and instructions and knowing the time required to answer it. The sample consisted of (100) female students from Cairo High School for Girls on Sunday

7/11/2021 to extract the psychometric characteristics of the test, and the researcher supervised its application in cooperation with subject teacher.

Statistical analysis of test items-

Paragraph Difficulty Index-

After calculating the number of correct answers for each of the paragraphs, the difficulty coefficients were calculated for each of the paragraphs of the generative thinking test. The special equation for paragraphs that takes into account partial knowledge was used in calculating the difficulty coefficients for the skills (fluency, flexibility) paragraphs, as the difficulty coefficients for the fluency skill ranged between (0.39-0.51), and the difficulty coefficients for the skill of flexibility between (0.40-0.52), as for the skills (making hypotheses, forecasting in the light of data, identifying errors and fallacies, representation) the special equation for a paragraph giving its answer was one or zero in calculating its difficulty coefficients if the difficulty coefficients for the skill (making hypotheses) ranged between (0.31-0.33), while the difficulty coefficients for the skill (prediction in light of the data) ranged between (0.24-0.43), and the difficulty coefficients skill (identifying errors and fallacies) ranged between (0.50-0.57), and the difficulty coefficients for the skill (representation) ranged between (0.56-0.59), annex (18), and the test items are considered acceptable if Its difficulty ranged between (0.20-0.80) (Al-Dahir et al., 1999:129), which means that the test items are acceptable and their difficulty range . suitable.

Discriminative Power of Paragraphs

The researcher used the equation of the discrimination coefficient for paragraphs that take into account partial knowledge in calculating the discriminatory strength of the paragraphs of skills (fluency, flexibility), as the discriminatory strength of the paragraphs of the fluency skill ranged between (0.37-0.48), and the discriminatory strength of the paragraphs of the skill of flexibility between (0.41-0.46). As for the skills (making hypotheses, forecasting in the light of data, identifying errors and fallacies, representation), the special equation for a paragraph giving its answer one or zero was used in calculating the discriminatory power, as the discriminatory power of paragraphs such as the skill (hypothesis setting) ranged between (0.37-0, 59), as for the discriminatory strength of the skill items (prediction in light of the data) it ranged between (0.26-0.0.48), as for the discriminatory strength of the skill (identifying errors and fallacies) it ranged between (0.52-0.78), and as for the discriminatory strength of the skill (Representation) ranged between (0.67-0.89), and the paragraph is good if its discriminatory strength is (0.40) or more, and if it ranged between (0.20-0.40), there is nothing wrong with it (Allam, 2000: 289) as well. In Appendix (18) and thus all article paragraphs are acceptable.

Confirming the psychometric properties of the test

The validity of the construction was verified by

A- The degree of the paragraph is related to the total degree of the skill to which it belongs.

The researcher used the Pearson correlation coefficient to extract the correlation between the scores of each of the test items and the total score of the skill to which the female students belong, the sample of statistical analysis amounted to (100) students, the results showed that all correlation coefficients are statistically

significant, as their values ranged between (0.44- 0.74), and these coefficients indicate the internal consistency of the test items.

B- Correlation of the paragraph's score with the total score of the test

The correlation coefficients between the scores of each of the test items and the total score of the total test were calculated using the Pearson correlation coefficient, the results showed that the items were all statistically significant, as their values ranged between (0.40-0.57)

C- Correlation coefficient between the scores of each domain in the overall test scores.

The correlation coefficient was extracted based on the correlation coefficient between the scores of each domain and the total test score, using Pearson correlation, and the results showed that all test items were statistically significant between (0.73-0.78), which is a good indicator of the validity of the construction validity of the generative thinking test.

Test stability

The stability of the test was calculated by the method of internal consistency by adopting the Alpha Cronbach equation, as the stability coefficient according to the Alpha Cronbach equation was (0.87), and this indicates that it is a good and acceptable stability coefficient, as it is an acceptable value for the stability coefficient.

Chapter Four

First: Presentation of results related to the generative test

To check the null hypothesis that

There is no statistically significant difference at the level (0.05) between the average scores of the experimental group students who studied according to the instructional-learning design of interactive electronic mind maps and the average scores of the control group who studied according to the usual method in the generative thinking test.

ways as follows; The researcher presented the results in **Generative thinking test**

A - To verify this hypothesis, the arithmetic mean, standard deviation, and t-value were found using the t-test for two independent samples to compare the mean scores of the experimental group and the mean scores of the control group in the generative thinking test..

Table (5)

The arithmetic mean, standard deviation, and T-value of the scores of the two groups (experimental and control) in the generative thinking test.

The group	Number of female students	Arithmetic mean	Standard deviation	Degree of freedom	T-value		Statistical significance at the level of significance 0.05
					Calculated	Tabular	
Experimental	31	17.48	4.88	61	4,09	2,00	Insignificant
Controlled	32	13.68	3.68				

.B-Impact size

To find out the size of the effect of the independent variable on the dependent variable mentioned above, the researcher adopted the Cohen equation to measure the effect of the independent variable on the dependent variable. The size of the effect was (1.046). It is a very large effect.

Second: Interpretation and discussion of the results.

Discuss and interpret the results of the Generative Reasoning Test.

The results of the current research showed that there is a statistically significant difference between the scores of the students of the experimental and control groups in the test of generative thinking, in favor of the students of the experimental group, with a large effect size. The researcher explains this by adopting the instructional-learning design according to the program of interactive electronic mind maps (I Mind Map10)

A- The instructional-learning design of interactive electronic mind maps (I Mind Map10) contributed to the creativity of the students by reaching the largest number of ideas in a specific time and their ability to quickly draw and imagine shapes for a number of visual stimuli and originality in terms of new ideas and unusual and predictive in light of the data available in the study situation.

B - The educational and learning activities provide better learning and lead to the development of generative thinking skills, as well as the use of interactive electronic mind maps, images and videos, which enhanced the students' abilities and contributed to the generation of information.

Third: Conclusions

The effect of this instructional-learning design on improving and developing the generative thinking test for fifth scientific grade female students.

Fourth: Recommendations

In light of the results of the research, the researcher concluded a set of recommendations, as follows;

1-Urging teachers and female teachers to adopt the interactive electronic mind map program (I Mind Map10) in teaching biology.

2-Urging female and male teachers to include tests with various questions and activities that raise the level of female students' achievement.

3.Involve teachers in training sessions to train them to teach according to this program.

Fifth, Suggestions

Complementing the research topic, suggest the following

1-Conducting similar studies to the current research in other disciplines such as chemistry and physics.

2-Conducting a similar study on other samples, such as students in stages other than the fifth scientific stage.

3-Studying the effectiveness of an educational and learning design prepared according to the interactive electronic mind mapping program in other variables.

References

1. -Buzan, Tony (2010): Mind Map, 6th edition, Saudi Arabia, Jarir Bookstore.
2. -Hassan, Ezzat Abdul Hamid (2011): Psychological and educational statistics applications using the 18 spss program, Arab Thought House, Cairo, Egypt.
3. -Hassan, Ibrahim Mohammad Yunus (2019): Theoretical foundations for designing electronic mental maps, 2019, Volume 25, November Issue, Part One.
4. -Al-Titi, Mohammad Hamad (2004): Developing Creative Thinking Capabilities, 2nd Edition, Dar Al Masirah for Publishing and Distribution, Amman.
5. -Al-Arabi, Naim Ahmed, Mufleh Ratib and Mustafa Youssef (2015): Teaching Design, 1st Edition, Dar Al-Hamid for Publishing and Distribution, Jordan.
6. -Allam, Salah El-Din (2000): Educational and psychological measurement and evaluation: its basics, applications and contemporary trends, Cairo, Arab Thought House.
7. -Al-Maliki, Adel Hamidi (2019): Mind Map (Traditional - Electronic - Super), 1st Edition, Center for Arabic Literature for Publishing and Distribution, Taif.
8. -Al-Wadiya, Raed Samih Muhammad (2019): "The effect of employing Appleton in developing generative thinking skills in science and life for seventh grade students", unpublished master's thesis, The Islamic University of Gaza, Gaza.
9. Buzan, Tony (2002), how To MindMap. London. Thorons-
10. -Entwistle N. (2000): Promoting deep learning through teaching and assessment , paper presented at AAHE conference, Jane, PP. 14-18.
11. -Zheng, L.Smaldino, S. (2003). Key instructional design elements for distance education, The Quarterly Review of Distance Education, 4(2), 153-166.