

The effect of using thinking maps strategy to improve science processes in science course on female students of the ninth grade

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Abstract: The study aimed to uncover the effect of using thinking maps strategy in the improvement of science processes in science course among Female Students of the Ninth Grade. To achieve the study objectives, the researchers used both of the experimental and descriptive curriculum. They also built a scale of science processes. The study has been applied on a sample of 40 female students from the ninth grade in Khanyounis school for females which are divided into (EG=20) and (CG=20) students. After the implementation the study discovered the existence effective impact to use thinking maps strategy to improve science processes of the female students of the experimental group.

Keywords: Thinking Maps Strategy, Science Processes, Classification Process, Conclusion Process, Observation Process

1. Introduction

The era in which we live now witness a tremendous development in various fields of life which is considered as a reflection of the great cognitive evolution in all branches of science and technology. As a result educators are facing problems on how to prepare future generations to deal with the science and technique that is associated with it to face the challenges of this era. This will prompt them to bring fundamental changes in the objectives of science teaching to make the student understand the science, as a knowledge and organized building which can be possible to be reached through careful observation, measurement and experimentation, and then the roads or operations that could be reached by, which is considered an integral part of science itself.

From this view, the American Association for the Advancement of Science (AAAS, 1993) pay attention to the goals of science teaching and rewrite its composition to suit the requirements of the current century, during planning of the project (2061), which began in 1989, through training the students to practice thinking skills, survey and the basic processes of science and integration.

The views of educators have agreed that there is

importance to rely on the teaching of science on the roads and the mental processes that to reach a scientific knowledge and focus on the relations between the student and the learning process and educated material, also that focus on practicing science skills of output task of the scientific education (Shehab & AL-jondi, 1998).

In this regard Albaeli (2003) confirms that learning science processes help students to learn new concepts apply what has been learned in new situations, and develop some mental processes such as: careful observation, data collection and analysis them, and having logical explanations to the phenomena, as well as some of the scientific and desired trends, such as curiosity, and scientific rigor and objectivity.

In the context of concerning on the development of science processes there were several strategies that are aimed to provoke thinking, attract attention, enhance absorption and improve the mental abilities of learners, including strategy of maps thinking, which is defined as the tools of effective thinking with high-efficiency represent optical Content, and innovative models for information content (Schlesinger, 2007:39)

The importance of maps thinking highlights as it helps to focus learner attention easily on ideas and make it easy to focus, freedom of thought and exploration, provide feedback to the ideas and complex meanings, allow changing and developing ideas easily and to express it in understanding way and characterized by diversity to meet all learners needs (*Idon, 2003*).

Thinking maps represent mental map followed by it the learner during practicing education process and thinking as it sets a starting point and finishing with putting technique to develop learners learning and monitor performance, to identify strengths points to be strengthened and weaknesses to be improved in order to achieve the desired goals of the education process, as it provides organized knowledge which is working to find a relations and interdependence between them and the abstract concepts which are involved, and practicing different science processes among students.

Also, Thinking maps can be stretched and adjusted during the process of explanation, those parts of the map can be expanded to help the student to concentrate, to exchange information, to participate with the teacher more positively, in addition to the discovery of the thoughts process which are behind the maps, where the advantage can come to the fullest extent of the classroom (*Logotron Educational Software, 2007*)

The benefits of these maps for each of the learner and the teacher will help to (*Scientific publication council, 2006:17*):

- Draw a total picture to the parts of the detailed subject.
- Rapid review of the subjects by the learners, when they do not find enough time for a detailed review.
- Ease in remembering data and information which are contained in the subject through remembering shapes that are drawn in their minds.

Also it's known as the eight - visual learning tools, each one of it establishes basic thinking operations in the brain which focuses on the cognitive and skilled basis such as comparison, contrast, relay, classification, cause, effect, description and analogies (*Thinking Maps R, 2007*)

From heir's view, its defined as its more than just organizational forms its and flexible and effective, and encourages lifelong learning and can be used in pre-kindergarten until post-graduate to the work site that is because they are based on a deep understanding (*Hyerle, 2004*) which is about eight forms of maps planning visual designed by David Hyerle, which are considered as tools used by the teacher and the learner to the teaching and learning of subject content (*Hyerle, 1995: 87*). The following is a presentation of these components in terms of the type of each maps and the thinking process that aims to it and realized, and questions that reflect each of them, as well as schematic form that use and expressed all maps of thinking as developed, "David Hyerle" (*Hyerle, 2000, 40*)

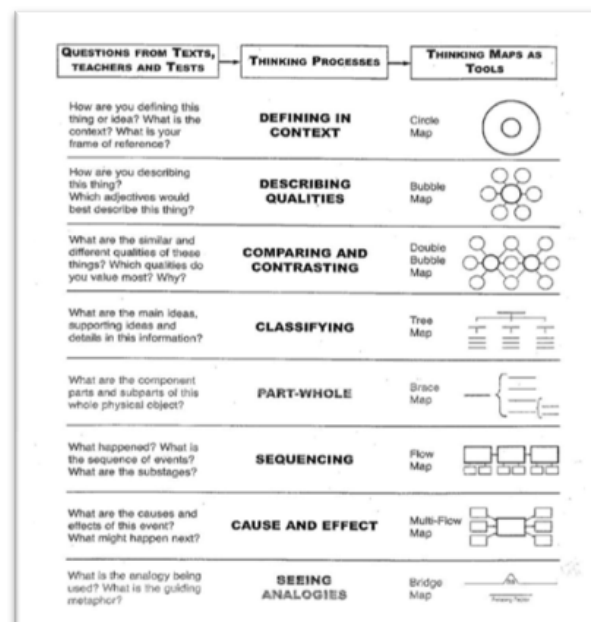
Also, thinking maps are considered an important and useful strategy for learning because it helps all students to learn and it's illustrated as follows: (*Holzman, 2004*)

- Simple and easy for the student to be used.

- Can be used in any semester or content of any education level.

- Can be used in the evaluation of student learning.

- Useful to illustrate the differences, particularly in language learning.



There are many studies that have used thinking maps, and explained its importance in teaching, and these studies:

Hyerle (2000) study, which have been applied in some schools in North Carolina, in the teaching biology course that's in 1995 and even in 2000, where the results showed the progress in the students level in the scientific material.

Curtis, Sarah (2001) study, which aimed to develop thinking maps on one of the New Hampshire city schools, the study has shown the importance of training and follow-up of thinking maps, as it leads to enhanced the thinking of both learners and educators, and their imagination.

Mabie (2006) study, which aimed to identify the extent of the link between teaching thinking maps and achievement in five primary classrooms, This is in science, mathematics and languages in three primary schools in the north -east of "Tennis" city, and the results indicated to achieve successful steps in the three schools to improve students achievement.

Assayed (2009) study, which aimed to study the effectiveness of the use of some thinking maps to teach science in achievement and gaining skills to solve problems among the student of the second preparatory class in the first semester, where the results showed that there were significant differences in favor of the experimental group, and in favor of dimensional application.

Fahmi (2008) study confirmed, that there are significant differences in the experimental group and post application in the achievement development, a deep understanding and motivation among the fifth-grade students in science course by using thinking maps.

2. Problem of the Study

The research problem is determined by the low level of science processes of the ninth grade students in teaching, and as a result of the traditional way which are use in teaching. Although the nature of the science curriculum of the basic level in Palestine rely on science processes, and its teaching requires teaching the students the ability to observe, deduction, the classification and others science processes, from this point we can determine the problem of the research to identify the impact of the use of maps thinking strategy in teaching science to develop science processes the main question:

What is the effect of using thinking maps strategy in the study of science to improve Science processes on the female ninth grade students?

There are sub-questions come from the main question:

What are science processes which are available in science course?

Are there any significant differences at the level of significance ($\alpha \geq 0.05$) in the processes of science among students of the control group and the experimental group students?

3. Research Objectives

This research aimed to achieve the following objectives:

- To design plant tissue unit in science subject to the ninth grade using thinking maps strategy.
- To improve science processes among the students through using thinking maps.
- To discover the impact of using thinking maps strategy in developing science processes among the female students of ninth grade.

4. Research Hypotheses

To answer the last research question research hypotheses formulated as follows:

There are statistically significant differences at the level of significance ($\alpha \geq 0.05$) between the mean scores of the control group and the experimental group on scale science operations for the benefit of the experimental group.

5. Importance of Research

The importance of research may:

- Contribute in discovering the role of thinking maps in developing science processes.
- Help those who develop the curriculum in Palestine to change their plans and strategies in curriculum development.
- Provide a model for the preparation of lessons according to thinking maps strategy in the study of science for the ninth grade primary and which can be used for similar work lessons in different courses.

6. Delimitation of the Study

Limited to sample in the ninth grade Khanyounis female students preparatory school, in the second semester of the year 2013-2014 AD.

7. Definition of Terms

The following definitions are developed by the researchers operationally to remove any ambiguity in understanding these terms through the research:

- Thinking maps strategy:

It's a visual tools learning which consist of eight thinking maps that connect each one of it with one or more than one process of science processes, these are used to improve science processes among the students in science course.

- Science Processes:

It's a group of mental processes which the students of ninth grade use during their learning to the content of "plant tissues" unit by using thinking maps strategy Also; it's a process of classification, conclusion and observation.

- Classification Process:

It's a processes which the student can classify things and data to groups according to a combined features between them.

- Conclusion Process:

It's a processes which aims to enable the student to reach a particular results which depend on thinking and imagination basis.

- Observation Process:

It's a processes which learner use all of his or her senses in observing things in order to gain information, collect evidences about things and know the similarities and differences between them.

8. Methods

In this study experimental research design, and post-test, experimental-control-group model were used. This study was carried out with 40 preparatory school student (EG=20, CG=20) in the 2013-2014 education year.

8.1. Data Collection Instruments

One scales Science Process Scale (SPS) is developed and used to collect data and measure the differences in the student's Science Process levels before and after the study depending on the methods at instruction used.

8.2. Science Process Scale (SPS)

8.2.1. Application of the Scales (Methodology)

Before the instruction, the students were divided in to two groups: Control group (CG) and Experiment group (EG), randomly. The Science Process Scales (SPS) were performed as pre- tests to both groups. In the next step the unit "plant tissues", a part of year 9 science curriculum, was taught to the control group (CG) by using chalk and talk method as commonly known name, the traditional method.

To the experimental group (EG) the same unit was taught by thinking maps strategy. The instruction period for both groups was one week. At the end of the both instructional methods used for CG and EG, SPS is applied to both groups as post tests.

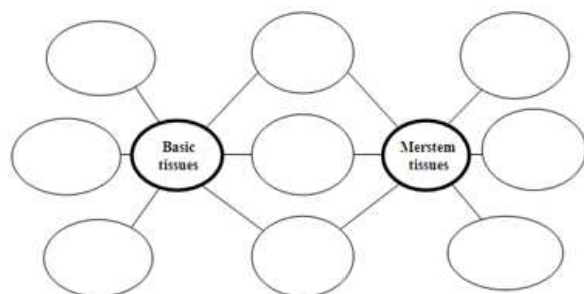


Figure 1. sample double bubble map used in this study.

8.3. Data Analysis

Data collected in this study were analyzed by using SPSS/PC version 15.0 statistical program. Two different t-tests were performed: Paired Samples t-test was conducted to determine whether there was a significant difference between pre-test and post-test results in each group, in-group analysis, as a result of the instructional methods used in the study. Independent Samples t-test was performed to identify whether knowledge levels of all students in CGs and EGs were equal or at least similar before the study, and to find out whether a significant changes arise between groups as a result of the instructional methods used. Significance Level was decided by taking P values in to consideration $P > 0.05$, meant there was not a meaningful difference, $P < 0.05$ meant there was a meaningful difference.

9. Findings

Results of the first question "What are science processes which are available in science course"?

To answer to this question, the two researchers analyzed the content "plant tissues" in science course to the ninth grade in the light of science processes, as its shown that science process which are available in the unit are classification, conclusion and observation process so by that, the two research answered the first question of the research question.

Results of the research Hypothesis "There are statistically significant differences at the level of significance (≤ 0.05) between the mean scores of the control group and the experimental group on scale science operations for the benefit of the experimental group"

Science Processes Scale was used as a pre-test for determining the readiness levels of both CG and EG and whether there was a statistically meaningful difference between the readiness scores of CG and EG, and as a post-test to see whether the applied instructional methods made a statistically meaningful difference at the end of the course.

Pre-test of all CG and EG, and post-test of all CG and EG were compared separately to see whether methods used in this study affected students improve of science processes. The results of the analysis are presented in Table 1 and 2.

Table 1. Control and Experimental group pre-test results of SPS.

	Group	No.	Means	Standard Deviation	T-test	Sig.
Pre-classification	CG	20	1.850	1.039	2.814	0.011
	EG	20	2.850	1.268		
Pre-conclusion	CG	20	2.200	0.951	1.301	0.209
	EG	20	2.250	1.118		
Pre-observation	CG	20	2.000	1.076	0.691	0.498
	EG	20	2.250	1.118		
Pre-test	CG	20	6.050	1.791	1.594	0.127
	EG	20	7.000	1.589		

Table 2. Control and Experimental group post-test results of SPS.

	Group	No.	Means	Standard Deviation	T-test	Sig.
Post-classification	EG	20	3.550	1.356	4.513	0.000
	CG	20	5.500	1.235		
Post-conclusion	EG	20	2.950	1.146	2.643	0.016
	CG	20	1.234	1.234		
Post-observation	CG	20	2.850	1.137	1.973	0.063
	EG	20	3.700	1.490		
Post-test	CG	20	9.350	1.348	7.190	0.000
	EG	20	13.250	2.268		

As indicated in table 1 there was no significant difference between students pre-test results ($p = 0.127$). In other words, both control and experimental groups were selected from students with similar knowledge level before the study. On the other hand, as it is seen from the table that post-test results was significantly different depending on the instructional methods used ($p = 0.000$).

The mean value of students who received the topic by traditional method in CG rose from 6.05 before the study to 9.35 after the study. However, the same value increased in EG from 7.00 to 13.25. These results implicate that students who were taught the topic through the thinking maps used in this study in EG were more successful than those students who received the topics through traditional chalk and take method in CG.

As shown in Table 2, there are statistically significant differences between the results of the student's in the process of classification ($P = 0.000$) between the control and experimental groups in favor of the experimental group, as can be seen from the above table that there are statistically significant differences between the results of the students in the process of conclusion ($P = 0.016$) between the control and experimental groups in favor of the experimental group. It is also evident from the above table that there are differences between the results of the students in the process of observation ($P = 0.063$) between the control and experimental groups in favor of the experimental group, but these differences did not reach the level of statistical

significance, As can be seen from the table that there are statistically significant differences between the students results in the test of science processes ($P=0.000$) between the control and experimental groups in favor of the experimental group.

10. Discussion

This study was conducted to determine the impact of the strategic of the thinking maps of science processes in plant tissues unit as a part of science course scheduled to ninth grade students. Study results showed that there is a positive impact and clear thinking in strategy maps in raising the level of scientific knowledge of science processes of female students of the experimental group through the use of strategic thinking maps in the teaching of science. The reason for this is to:

- Use the strategy of thinking maps which are given to students as a chance to understand the careful analysis of the content and the ideas contained and categorized them.
- Build the students thinking maps contributed to organize the content of the lesson and linking concepts and activities which facilitated their process of observation and conclusion process.
- Use thinking maps strategy provided a visual, coherent and well planned display for the students as a result, this help on raising their attention, and remembering the greatest possible number of concepts, thus increase the scientific knowledge of science processes.
- Engage students with the researcher in designing and preparing thinking maps has allowed an atmosphere of cooperation and increasing in the level of motivation to learn, which contributed in the Acquisition of science for the students.
- Enabling the students of experimental group to build thinking maps has helped to strengthen the self-confidence and energize science processes, as well as to take responsibility for the implementation of learning while doing some of the activities.

The results of this study support the results of the research on the effectiveness of the use of thinking maps strategy in increasing scientific knowledge and the development of academic achievement (*Hindman, Jeunifer, 2000; Holzman, Stefanie, 2004; Al-Baz, 2007; Fahmi, 2008 and Assayd, 2009*). In addition, *Easterbrooks and scheetz (2004), Lang and lewis (2009)* and *Hassan (2011)* showed differences in science processes (observation, classification, measurement, prediction, conclusion, communication, the use of numbers and the use of temporal and spatial relations) between the two applications (pre and post) that favors to the post application as a result of using the strategy of thinking maps.

Recommendations

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

- Adopting the use of the strategy of thinking maps in teaching from the teachers as one of the effective means to the learner.
- Making work sheets aim to show the importance of using thinking maps strategy in teaching.

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