

**Action Research Study
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Title of the Study:
Using Concept Maps in Biology Lessons
Location or Institution
Omar Bin Al Khattab Secondary Schools
Abstract
<p>This action research studied the effects of using concept mapping on the students understanding of biological concepts and chemical pathways in biology lessons. Two grade 11 biology classes completed a unit on breathing with the same teacher using the same materials and lessons, with concept mapping being the independent variable compared. The study included observation, an objective test, evaluation rubrics, and an attitudinal survey as measurement instruments. There was little difference in achievement between the two groups. According to surveys, students were agreeably engaged in concept mapping and found value in it. The experimental group scored slightly higher on the problem-solving activity and reasoning questions, which suggests concept map organization may lead to a clearer understanding of content.</p>
Grade Level: secondary
Data Collection Methods:
<ul style="list-style-type: none">• Observation• Objective test• Evaluation rubrics• Attitudinal survey
Subject/Topic: Science (Biology)

Using concept maps

Action research

By Firas A. M. Cerri & Radwan O. Al-Abed

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I. Abstract :

This action research studied the effects of using concept mapping on the students understanding of biological concepts and chemical pathways in biology lessons. Two grade 11 biology classes completed a unit on breathing with the same teacher using the same materials and lessons, with concept mapping being the independent variable compared. The study included observation, an objective test, evaluation rubrics, and an attitudinal survey as measurement instruments. There was little difference in achievement between the two groups. According to surveys, students were agreeably engaged in concept mapping and found value in it. The experimental group scored slightly higher on the problem-solving activity and reasoning questions, which suggests concept map organization may lead to a clearer understanding of content.

II. Introduction :

Students sometimes have difficulties in biology lessons. They suffer a lot because the subjects of biology contain a lot of concepts, pathways and cascade events. Our students found that it is difficult to remember the steps of pathways in biology or even they seem to be memorizing facts to be filled in on tests and then promptly forgetting what they have learned. We are frequently surprised by what students don't know or what they are unable to express in a meaningful way.

Meaningful learning requires intentionally connecting new ideas or concepts with previously acquired knowledge. Concept mapping may be a way for students to achieve meaningful learning by connecting new facts to already existing knowledge. Concept mapping is a technique for visualizing the relationships among different concepts. It is a diagram showing the relationships among concepts. Concepts are connected with labelled arrows, in a downward-branching hierarchical structure. The relationship between concepts is articulated in linking phrases, e.g., "gives rise to", "results in", "is required by," or "contributes to". (*Wikipedia*).

The purpose of this research was to study the effects of using concept mapping on the student understanding of biological concepts and cascade pathways in biology lessons by

grade 11 science students. The independent variable in this research was the use of concept mapping to facilitate meaningful learning.

III. Methodology

Participants

Two grade 11 biology classes participated in this action research, taught by the same teacher, used the same materials and lessons, with concept mapping being the independent variable compared. I divided the students into two groups. The experimental group (group E) contained 25 students. And the control group (group C) also contained 25 students.

A previous biology test was designed for the two groups. Statistical analysis showed that there were no significance differences between the two groups.

Intervention

The classes were engaged in a three-week biology unit on breathing and the effect of tobacco smoke in the respiratory system.

In the experimental class, we used concept maps as illustrations during instruction. Students were given opportunities to make, edit, and expand their own concept maps each week during the unit. All other instructional materials were the same for both classes.

Measures and Procedures

The teacher presented the topic to the students during biology classes. Twice a week, the students in the experimental class work on their concept maps. Using a rubric, the student maps were analyzed throughout the unit to formatively evaluate the instruction and the concepts students were depicting. Misconceptions were corrected as needed. Teacher-made unit test scores of the two classes were compared. A problem-solving question requiring application of knowledge was given to both classes at the completion of the unit to compare the students' ability to transfer what they learned to a novel situation. Teacher and student comments recorded in an observation log and responses in surveys on their concept mapping experience were examined.

IV. Results :

Scores on the pretest and end of unit tests, and surveys were analyzed to uncover discrepancies between the experimental and control group.

The analysis of the pretest at the beginning of the research scores seen in Table 1

Group	Average	Standard deviation	Max	Min
E	38.96	8.39	50	23
C	38.84	8.06	50	22

Table – 1 : analysis of the pretest scores

The analysis of the end of unit test scores seen in table - 2

Group	Average	Standard deviation	Max	Min
E	40.12	9.11	50	18
C	39	7.78	50	22

Table – 2 : analysis of the end of unit test scores

Pearson's chi-square (χ^2) test was carried to show if there is any significance in the differences in results between the two groups.

$$\chi^2 = \frac{(40.12 - 38.89)^2}{40.12} + \frac{(39 - 38.84)^2}{39} = 0.038$$

This result helped the researcher ascertain that concept mapping had no significant impact on learning and retention. The control class actually scored a little higher on average.

The Attitudinal Surveys were compared to see if there is a consensus of opinion about the use of concept maps among students. A scale of 5 was used to determine the degree of agreement with statements about concept mapping. (5=Strongly Agree, 4=Agree, 3=Neutral, 2=Disagree, 1=Strongly Disagree).

The students' responses are shown in Table 3 below. Comments ranged from neutral to favorable on the use of concept maps as an instructional tool.

Statement	Mean (out of 5)	High	Score range	St.Div.
1. I enjoy making concept maps.	3.8	5	2 – 5	6.5
2. Concept maps help me understand the information better.	4.1	5	3 – 5	4.2
3. When the teacher uses a concept map to explain things, it makes more sense.	4.3	5	4 – 5	2.1
4. Concept maps help me organize my thoughts	3.9	5	3 – 5	4.6
5. Concept maps help me study for tests	3.2	5	4 – 5	1.8
6. At the end of a unit, I would rather make a concept map showing what I know rather than take a test.	3.1	4	1 – 4	7.3
7. Concept map is easy to use.	4.1	5	3 – 5	4.5
8. I can use concept maps to show my ideas and how they connect to each other.	3.5	5	3 – 5	4.1
9. It is easier to use a computer to make a concept map than to draw it by hand.	4.6	5	3 – 5	3.2
10. I would like to use concept maps more often.	4.2	5	1 – 5	8.9

Table 3-Results of students' attitudinal surveys

A few students made sophisticated concept maps, while the others were simplistic but accurate.

V. Discussion and recommendations:

The statistical analysis of the pre-test and end-of unit exam results showed that there was a little effect of the using of concept maps on the score of the students, which indicates no effect of the concept mapping on the level of understanding of students for scientific concepts and pathways. But what was interesting is that students in experimental group scored better in problem solving and reasoning questions.

Concept map evaluation showed a steady increase in the quantity and quality of the information on the concept maps. Students added nodes and links as they gained more knowledge.

Responses of students to the survey showed that they enjoyed building their concept maps. Students need longer time to build the concept map but shorter time to revise the lesson again by using the concept maps prepared.

In a future action research I will try to ask students to use computers to build their own concept maps, this may make the task easier and funnier for them.