# CONCEPT MAPS AS A TOOL FOR BETTER LEARNING BIOLOGY IN HIGH SCHOOL

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## ABSTRACT

The main aim of the present study was to explore whether the students achieve better learning results while using traditional (frontal) method or conceptual maps during their learning process. As well, we aimed to explore the relationship between the usage of conceptual maps and long-term memorization. This research was conducted in the school years 2013/2014 and 2014/2015 on the sample of 101 students attending second grade of Natural sciences and mathematics highschool in Osijek. This study included several lessons dealing with "Birds" and "Mammals" as well as associated quizzes, and final and repeated final tests. With two student groups, the lessons were conducted by means of frontal method, whereas with two other groups of students the same teaching units were processed by using conceptual maps. The results showed that students who use conceptual maps achieve better results in comparison with the students who have processed new teaching units by the means of frontal method. On the basis of a repeated written final test we conclude that conceptual maps help students gain long-term memory of acquired knowledge.

**Keywords:** active learning, conceptual maps, cognitive levels, retention of knowledge

## INTRODUCTION

Concept mapping is a technique for visualizing the connections between different concepts that help students and others to organize and structure knowledge. Memory organized into conceptual structure is more efficient and permanent in relation to accumulation of unrelated individual information (Lukša, 2011). Each student creates his own concept in a specific way. Concept maps are widely used in primary, secondary and even in higher education. They are used to plan the learning process, making notes, problem solving and assessing the quality of learning. They help students to understand the connections and reach higher cognitive abilities.

The aim of this study was to explore whether the students achieve better learning results while using traditional (expository) teaching technique or concept maps during their learning process. As well, we explore the relationship between the concept maps and long-term memory.

## METHODS

Four stage research was conducted at 101 students of gymnasia in Osijek. The students were divided into two groups differing in the teaching and learning techniques within their biology classes. Control group were students who learned biology using traditional, expository teaching technique while experimental groups were students who learned same subjects using concept maps. First stage was first test conducted to evaluate the students' initial knowledge acquired before our study. The second stage was teaching two topics, "Birds" and "Mammals". The third stage was the second test conducted to evaluate learning success of all student. To evaluate the retention of knowledge three months after learning, same second test was written in fourth stage of the study.



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Metric analysis of the both tests (first and second) involved: Cronbach's alpha coefficient and the assessment of quality of each questions according to the methodology proposed in Radanović et.all. (2010). Also, for each question in both tests the achievement level according to Crooks taxonomies were determinate. According to Crooks, both test had the questions of first (involves recalling memorized facts) and second (conceptual understanding and applying) level of learning. To evaluate learning success the results of each tests were compared between control groups of students and experimental groups of students. For this purpose the independent-samples t-test was used.

## RESULTS

First test analysis showed that the both student groups (control and experimental) are very similar in their prior knowledge. In the second test experimental groups achieve significantly better results in relation to control groups ($t_{90}$ = 5.18; p <0.001). In first test students from the both groups responded better to the questions of first level of learning in relation to questions of second level. Same phenomenon was present in second test. In the second test experimental group achieved significantly better results answering questions from the first level of learning compared to the control group ($t_{90}$ = 3.70; p <0.001) as well as the questions from second levels of learning (t90 = 3.97; p <0.001). After three months students from experimental group achieved better results in relation to control groups in the same second test.

## DISCUSSION AND CONCLUSIONS

Conducted first test gave an insight into the quality of the student's prior knowledge which are very important for concept mapping. In our study both groups of students showed similar prior knowledge. Students who used concept maps in learning process achieved better results than students who used expository teaching techniques. Similar research results were obtained by Adamov et al. (2009). Our study shows that students who used the concept maps have a greater success in questions of second level of learning. That means that students understand and can apply their knowledge in different new situations and in everyday life. Repeated second test shows that students who were learning by using concept maps after certain period of time have acquired more knowledge than the students who were learning in traditional way which leads to the conclusion that concept maps help students to achieved permanent knowledge. Many authors have confirmed that students who are actively involved in learning retain information longer than those who are passive participants in the teaching process (Allen and Tanner, 2006; Modell, 1996; Smith et. all., 2005). Conceptual maps in learning process could encourage the creation of modern, active and interesting lectures where students construct different concepts, beside just memorizing facts.

Concept maps are suitable for measuring the quality of knowledge and are recommended as the preferred strategy of learning in secondary education (Hay et all. 2008). Results of our study point value of conceptual maps in learning process, but they can also be used for repetition, the assessment of knowledge and identification of the student's misconception.

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