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THE USE OF CONCEPT MAPS IN TEACHING COMPUTER SCIENCE

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Abstract. Concept maps help visualizing the key concepts as well as summarizing the concepts and also their relevant relationships. Therefore the memorizing and remembering processes will be facilitated (Hatami, Mirzayee, Abbasy, 2009). According to the meaningful learning theory, interrelated sciences of a single academic major are organized in a pyramidal, imaginary design and hierarchical order, in which the cognitive structure provides the scientific grounds. The research design in this work is a semi-experimental design containing pretest and posttest. The sample is 81 bachelor's students of Computer Engineering whom were selected by purposive sampling. The outcome of this project indicates that the teaching based on the concept maps has positive influences on increasing the students' achievement and grades in the subject of the Distributed Systems.

1 Introduction

Science and technology curriculum are based on the constructivist approach. This presumes that the students construct the knowledge actively in their minds (almost independently?) on their own. When the students construct the Science and Technology subjects and the relevant concepts correctly in their minds, meaningful learning is realized (Aydin & Balim, 2009). According to the meaningful learning theory, interrelated sciences of a single academic major are organized in a pyramidal, imaginary design hierarchical order in which the cognitive structure provides the scientific grounds. Based on this theory, in designing and presenting the subject materials, first the most general, comprehensive and abstract concepts and thoughts must be presented and then subsidiary materials must gradually (Seif 2008).

Concept mapping is one of the modern teaching methods, which have its origin in the constructivism learning theory. Utilizing concept maps in teaching helps instructors to provide their students with a clear picture of topics and their relationships. In this regard neglecting or misunderstanding of important concepts becomes almost improbable. Concept maps help visualizing the key concepts as well as summarizing and the relationships between them. Therefore the memorizing and remembering processes will be facilitated (Aydin & Balim, 2009). Concept maps were developed on the basis of psychological theories of David Ausubel, in 1972 in the course of Novak's research program at Cornell University. A significant point of David Ausubel's theories is that learning happens by building relationships between new concepts, topics and the existing concepts of the conceptual structure of the learner (Abbasy 2008). Many researches on concept mapping have proved that it can improve a meaningful learning and help beginners to learn independently (Abbasy 2008; Pia, Blasco, Portero, 2011; Yekta & Nasrabadi, 2004; Mendia & Garica, 2008; West et al., 2002). During the process of this study the researchers interviewed many children. They found it is almost difficult to identify specific changes in the children's understanding of science concepts by examination of interview transcripts.

Thus a new tool was born not only to use in research, but also for some more purposes (Novak & Cañas, 2008)]. Novak found that the use of concept maps could help students learn how to learn meaningfully (Novak & Cañas, 2010). Concept mapping serves as a strategy to help learners organize their cognitive frameworks in their minds into more powerful integrated patterns (Chiou, 2008). It is a graphical representation of knowledge that are comprised of concepts and the relationships between them. Here a concept which is designated by a label, as a perceived regularity in events or objects, or a record of events or objects, will be defined. Concepts are usually enclosed in circles or boxes whilst relationships between concepts are indicated by connecting linking lines. Words over the linking line specify the relationship between the concepts. The label for most concepts is a single word, although sometimes symbols such as + or % may be used. Concept-link-concept triples form propositions, which are meaningful statements about some object or event. Sometimes these are called semantic units, or units of meaning (Coffey et al, 2003).

2 Method

The research procedure, here is a semi-experimental design containing pretest and posttest. In this project, 81 bachelor's students of Computer Engineering were selected by purposive sampling. The used materials were taken from the "Distributed Systems" subject. A pretest was taken in order to measure the prior knowledge of the students. Thereafter, the students were randomly divided into two groups of the control and the

experimental. Both groups were subjected to simultaneous and similar training but gaining different methods. The conventional method was used for the control group whilst the experimental group was taught using the concept maps. The SSPS-14 statistical analysis software was used to analyze the data. However to compare the achieved grades of the two groups an independent t-test was used.

3 The procedure

The purpose of this project is to study the effects of using the concept map in learning Distributed Systems. It is primarily necessary to measure prior knowledge of both groups. In this regard a pretest was taken from the students at the same time and of course under the same condition. The results are as follow:

Table 1. Mean and standard deviation of the pretest

Groups	No. of Students	The mean	The Std. Deviation	The Error
The experimental	42	4.8571	2.34335	0.36159
The control	39	5.0256	2.33382	0.37371

In the pretest, there was not observed much difference in the mean and the standard deviation of the grades of the two groups, but is this difference meaningful? To find out, an independent t-test was used.

Table 2. The independent t-test to compare the mean of the pretest grades

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
score	Equal variances assumed	.001	.981	-.324	79	.747	-.16850	.52008	-1.20370	.86670
	Equal variances not assumed			-.324	78.604	.747	-.16850	.52000	-1.20362	.86662

In the t-test table, $p > 0.05$ and the calculated t ($t=-0.324$) with a meaningful level of 0.05 and degrees of freedom of 79 ($DF=79$) is less than the table t ($t=2.000$). Therefore the difference between the means of the two groups is not meaningful.

Table 3. The mean and the standard deviation of the two groups in posttest

Groups	No. of Students	The mean	The Std. Deviation	The Error
The experimental	42	15.9286	2.24579	.34653
The control	39	14.0256	2.90632	.46538

Table 3 indicates that the means of the two groups are different. In order to assess the significance of the difference a similar t-test is used.

Table 4. The independent t-test to compare the posttest grades

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
score	Equal variances assumed	2.386	.126	3.311	79	.001	1.90293	.57476	.75889	3.04697
	Equal variances not assumed			3.280	71.460	.002	1.90293	.58023	.74611	3.05975

In the t-test table, calculated t (t=3.311) with a meaningful level of 0.05 and degrees of freedom of 79 (DF=79) is found more than the previous table at t (t=2.000). Therefore the difference between two groups is found meaningful and with 95% confidence for the statistics the method involving the concept maps was more efficient than the conventional counterpart.

4 Conclusion

Today developing meaningful learning is of primary purpose to teach the learners. It is accordingly a crucial factor to develop creative and critical thinking together with problem solving skills. These have made experts to suggest various teaching methods such as concept maps in order to develop meaningful learning. Findings of this project indicate that teaching based on concept maps has positive influences on increasing the students' achievements and thereafter grades in subject of the Distributed Systems. Providing the concept map helps improving the meaningful learning. To draw a concept map, the learner must first acquire necessary information about the subject matter.

Results of this research showed that teaching based on concept mapping is effective on learning method. Based on the results of this study concept mapping methods as a main route of teaching or as a complementary strategy for traditional teaching method may improve the students' knowledge. In this study 81 bachelor's students of Computer Engineering are divided into two groups (concept mapping and traditional method. The results showed that using the concept-mapping techniques provides more educational Improvement with respect the traditional teaching methods.

5 References

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