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THE INFLUENCE OF A CONCEPT MAPPING-BASED EXAM ON STUDENTS' EXAM PERFORMANCE

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ABSTRACT

The aim of the study was to explore the effect of Concept Mapping (CM) exam on students' retention and students' exam performance. Two sets of exams were to be developed: a regular format exam and a Concept Mapping-Based Exam.The Concept Mapping-Based Exam contained a blank concept map similar to the ones in the 7th-grade student's science book.Both exams have the same number of questions.Seventy students from grade 7th at Al-Arqam Ibn-Abil-Arqam School, one of the Basic Education schools in Oman, where the sample of the study was taught in two units from the 7th grade students' science book by the regular teaching method and by the same teacher. Thirty students participated in taking the exam, 16 were to do the regular exam and 16 were to do the Concept Mapping-Based Exam. The exams were distributed to them randomly. The study showed that the students who took the Concept Mapping-Based Exam outscored those who took the regular one.It is interesting that the study showed there was a positive correlation between recalling information and the presence of Concept Maps in the 7th grade student's science book as the exams showed.

KEYWORDS: *Concept Mapping, Basic Education, Positive Correlation*

INTRODUCTION

Teachers need to know how their students learn to help them excel in their learning. In other words, it is important for teachers to know how students process, store and retrieve information.Some teachers teach students without having much formal knowledge of how students learn (Fry, Ketteridge, & Marshall, 2009). Therefore, teachers need to use techniques/approaches to help students learn information more effectively.

There are no simple answers to the questions ‘how do learners learn?' and ‘how teachers bring about learning?' The knowledge about the relationship between teaching and learning is still incomplete, but teachers do not know enough about learning to be able to make any firm statements about types of action that will usually be helpful in enabling learning to happen (Fry, Ketteridge, & Marshall, 2009).

Some literature shows that students learn through organizing the new information in a certain schema. Schema is the map about a certain topic or theme that helps the learners to put new information into a meaningful context (Anderson, 1984, p. 5).To do this, learners have to activate their schemata to interpret the texts and to make sense and this is called the schema theory which “focuses on the role of the individual in the comprehension process and how background knowledge and interests influence the reader’ interpretation” (Omaggio, 1993).

Ausubel states that "as a result of this type of anchorage to cognitive structure, the newly-learned material is no longer dependent for its incorporation and retention on the frail human capacity for assimilating and retaining arbitrary associations" (Ausubel, 1967: 20).Morton (2018) maintains, "Concept mapping tools allow you or your students to visually depict a system of relationships by creating a map in which nodes represent ideas or facts, and the lines or connectors between nodes represent relationships".This came along with the Schema Theory, which suggests that learners take new information and stores it in the pre-existing hierarchies or channels (Dye, 2000).They reduce the amount of incoming information through deleting the unimportant ones, they will easily store the information in their long-term memory instead of the working memory and then they can remember them quickly (Sweller, 1988).

Vanides, Yin, Tomita, & Ruiz-Primo (2005) maintain that the teachers can have insights into how learners organize and represent knowledge when their students create Concepts Maps.

The Concept Maps can be used as a tool to assess students' learning.Tuan & Thuan (2011) argue that Concept Mapping has been proved asa powerful instructional tool, which assists teachers to assess learners' understanding and make connections between concepts explicitly.Ruiz-Primo (2004) maintains that the use of Concept Maps to evaluate student declarative knowledge structure is appealing. A student's map directly reflects, to some degree, a student's understanding in a domain; there is a potential in using concept maps as assessment instruments.

Varghese (2009) views the use of Concept Map as an effective way of looking at what is inside the learner's mind and reveals a conceptual understanding that is not generally identifiable by other assessment tools such as written tests.This can be a useful strategy for assessing the knowledge of the learnershave before engaging in the further learning or a new program or course (Hay, Kinchin & Baker, 2008).

The Significance of the Study

In Oman Government schools, student learning assessment is based on the traditional test.The items in the traditional test can be written in various formats such as multiple choice, matching, true/false, short answer, and essay.Some of these tests require students to memorize knowledge.The aim of this study is to explore the effectiveness of using Concepts Maps as an assessment tool for students' performance.Approving effectiveness, teachers can use Concept Maps as tools to assess their students' performance; helping to recall information easily in the process, they learned information.

The Study Questions and Hypothesis

- What impact does Concept Maps have over students’ retention?
- Is there any significant difference in the performance of students taking Concept Maps exam and of those taking normal exams?

Context of the Study

The Government schools in Oman underwent an educational reform in 1998 and the Ministry of Education introduced a new school system called "Basic Education system" in the academic year 1999-1998 (Al-Issa & Al-Bulushi, 2012). The new system consisted of 10 years of Basic Education (Grades 1 to 10) and 2 years of Post-Basic Education (Grades 11 and 12). The Basic Education has two cycles which are Cycle 1, consisting of grades 1- 4, and Cycle 2,

containing grades from 5 to 10 (Al-Jardani, 2014). The current study was conducted in one of the male schools in Cycle 2 (Al-Arqam Ibn-Abil-Arqam School) and specifically in grade 7 in the science subject. The science book consisted of five units and this study utilized unit 4 as it is the most suitable unit to perform the experiment and it is convenient to employ the Concept Mapping format for the assessment. The unit is entitled "Changes in the Earth Crust" and it contained five lessons. The teacher taught this unit for two weeks.

STUDY DESIGN AND INSTRUMENTATION

The study took place in semester two of the academic year 2017-2018. Before conducting the study, the researchers chose one class randomly and they divided the class into two groups randomly; the control group and the experimental group consisted of 16 students each. To check the homogeneity of the two groups, the researchers looked at the scores of the students in four tests taken previously. Table 1 and Table 2 show the students' scores in these tests.

Table 1: Shows the Students' Scores in These Tests

Group	Quiz1	Quiz2	Quiz3	Mean	Group	Quiz1	Quiz2	Quiz3	Mean
Control	8	4	5	13.7	experimental	4.5	8	7.5	15.0
Control	2	7	7	11.3	experimental	4	5	6	11.0
Control	6.5	4	7	12.8	experimental	3.5	10	8	16.2
Control	7	8	7	17.3	experimental	5	6	8	13.7
Control	3.5	5	6	10.5	experimental	7	10	7.5	19.5
Control	6.5	6	6	14.5	experimental	9	5	9	17.0
Control	9	10	10	22.3	experimental	10	9	10	22.3
Control	9	7	8.5	18.8	experimental	5.5	4	6.5	11.7
Control	2	5	7.5	9.5	experimental	7	8	8	17.7
Control	4	2	5	7.7	experimental	6	9	7	17.3
Control	10	8	7.5	20.5	experimental	10	10	8	22.7
Control	8	7	9.5	18.2	experimental	6	6	4.5	13.5
Control	8	6	5.5	15.8	experimental	8	9	5	18.7
Control	5.5	3	7.5	11.0	experimental	10	8	8	20.7
Control	5.5	6	6	13.5	experimental	8	9	10	20.3
Control	7	5	6	14.0	experimental	3	1	10	7.3

Table 2: Summarizes the Result

Group	Mean	N	Std. Deviation
Control	6.344	16	2.4408
Experiential	6.656	16	2.3503

Table 3 shows the results of the tests indicating that there is no statistical difference between the two groups, thus, the two groups are homogeneous and equivalent for conducting the study.

Table 3: Means and Stander Deviation for Groups Homogeneous Exam Results

	Groups	N	Mean	Std. Deviation	T	Sig
Quiz One	Control	16	6.344	2.4408	-.369	
	Experimental	16	6.656	2.3503	-.369	0.959
Quiz Two	Control	16	5.813	2.0402	-1.826	
	Experimental	16	7.313	2.5747	-1.826	0.263
Quiz Three	Control	16	6.938	1.4705	-1.361	0.787
	Experimental	16	7.688	1.6419	-1.361	

Measure

The teacher designed two tests that measured the knowledge, which students learned in unit four. The two tests consisted of five questions, however, the first test assessed the conceptual knowledge in that unit in a normal way (as tables and points) for the control group and the second test assessed the same information-usingconcept-mapping format for the experimental group. After finishing teaching unit four, the researchers administered the two tests for the experimental group and the control group. Figure 1 shows an example of question 3 for the control group and Figure (1) illustrates an example of the same question for the experimental group.

Figure 1:Sample of Question (4) For The Control Groupand Question (2) For Concept Map Exam

RESULTS

Table 4 shows that the experimental group outperformed the control group in all five questions of the test. Furthermore, the overall scores of the experimental group are higher than the control group indicating that the Concept-Mapping format has a positive effect on students' performance in the test.

Table 4: Descriptive Statisticsfor Students' Exam Performance

	Group	N	Mean	Std. Deviation
Q1	Control	16	2.625	2.1794
	Experimental	16	2.156	1.9555
Q2	Control	16	.000	.0000
	Experimental	16	3.063	2.6700
Q3	Control	16	.625	1.2450
	Experimental	16	1.969	1.4079
Q4	Control	16	.250	.5774
	Experimental	16	1.125	.8466
Q5	Control	16	.813	1.7970
	Experimental	16	.938	2.0484
Overall	**Control**	**16**	**.8625**	**.72560**
	Experimental	**16**	**1.8500**	**1.37695**

Moreover, Table 5 indicates that there is a significant difference between the control group and the experimental group in favour of the experimental group in the overall score.

Table 5: Indenpdent T. Test for the Control Group and the ExperimentalGroup

	Group	N	Mean	Std. Deviation	F	Sig.
Overall	Control	16	.8625	.8625		
	Experimental	16	1.850	1.8500	7.066	.017

However, looking at each question separately, it is noticeable that questions 2, 3, and 4 obtained a statistical difference, though there was no statistical difference in questions 1 and 5.

Table 6: The Independent T-Test for the Two Groups in Exam 5 Questions

	T	Df	Sig.	Mean Difference
Question#1	.640	30	.527	.4688
Question#2	-4.588	30	.000	-3.0625
Question#3	-2.860	30	.008	-1.3438
Question#4	-3.416	30	.002	-.8750
Question#5	-.183	30	.856	-.1250

The researchers contributed the result of no significant difference for question one and question five to the visual clues given in the two questions; the two questions in a traditional format contain tables which might help the students to recall the required information to answer the questions as shown in the figures below.

Figure 2:Question #1and Question #2 in the Traditional Format

Furthermore, it is interesting to notice that the scores of the students higher for the information which is presented in maps concept (in the Ninth science book). For examples, the concept map in question two is similar to the concept map and the concept map in question three is similar to the concept map in the student's textbook: mean=3.063and mean=1.85; see Figure (3) and Figure (4).

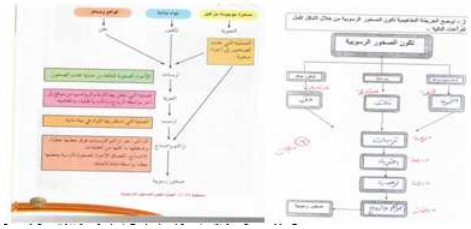

Figure 3: Page (121) From Student's Textbook and Question (2) From Concept Map Exam

Figure 4: Page (125) From Student's Textbook and Question (3) From Concept Map Exam

CONCLUSIONS

Generally speaking, the study reveals the importance of Concept Maps in drawing a conclusion about how students learn, store and retrieve information. The study shows a positive impact of using Concept Maps in exams; the students who took the exam, which contained Concept Maps scored higher than their counterparts; Also, the researchers found out the scores of the students higher for the information which is presented in Maps Concept (in the Ninth science book).Therefore, it is safe to say, that teachers can incorporate Concepts Maps in their exams to help their students retrieve the learned information effectively

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