THE INFLUENCE OF TEACHING NOTE-TAKING AND INFORMATION MAPPING ON LEARNING AND RECALLING IN SCIENCE

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ABSTRACT
This work describes an experimental research on note taking and concept mapping in a science class of 5 graders in Kayseri (Central Anatolia, Turkey) in the academic year 2002 - 2003. Gained results are in favor of convictions that view note taking as an effective learning strategy. At least it was more effective than concept mapping in the experiments of the present study. A possible reason for this is that students benefited from their notes by recapitulating lesson contents whereas concept maps were not used in such a way. This assumption is supported by other experimental evidence that ascribe the advantages of note taking to its function as external memory store that helps students to better process lesson contents.

Key words: Note taking, concept mapping, experimental, science, and primary education

1. INTRODUCTION

Note taking is a general learning strategy that has been well studied in a variety of different learning environments (Akinsanya and Williams, 2004). Patterson et al. (1992) classify note taking as an organizing and focusing strategy. Notes help to remember the important points of a lesson and can be used for revision and reference purposes. There are three benefits of note taking. First, it increases attention to the lesson. While recording a set of notes it is impossible for a student to get bored or inattentive. Second, it aids memory for the lesson. It is easier to remember noted lesson points than non-noted points. Third, it produces a set of notes available for review. Since memory is fallible, it is necessary to review the subject.

The results obtained from studies on note taking strategies are controversial. According to many studies, students who take notes perform better than those who do not (Kiewra, 1985). Some researchers found that note taking is effective on recalling (Fisher and Harris, 1973; Kiewra et al., 1989; Rish and Kiewra 1990) and assists students' learning (Annis and Davis, 1975; DiVesta and Gray, 1972; Barnett et al., 1981; Kardash and Kroeker, 1989). Note taking assists student's learning during both encoding and storage stages. The encoding effect is the result of the process of attending to and recording important details of a lesson. It is argued that the storage effect is the result of the reviewing of notes. The combined effect of encoding and storage processing is said to be more beneficial than encoding on its own (Hartley, 1983; Kiewra et al., 1991, 1995; Peper and Mayer, 1978, 1986).

On the other hand, a number of other studies have found no advantage of taking notes. These studies indicate that note taking has no significant effect on the general performance of students (Lipsky, 1984). Peper and Mayer (1978) show that while note taking has no effect on general performance, it does have an effect for low capacity students. Thus, the effect of note taking may depend on the level of students. Kiewra (1985) suggested that these different results are due to the type of note taking practice. Sometimes students record exactly everything what a teacher says with very little engagement. At other times, students employ "conceptual note taking" (Rickards and McCormick, 1988), summarizing (King, 1992) or self-questioning (Spires, 1993). All these latter types of note taking involve significant levels of engagement and are thus more effective (Trafton and Tricket, 2001).

Concept maps are schematic diagrams that use a graphical/verbal system to illustrate the relation of one concept to another (Nowak and Gwin, 1984). Concept maps should not simply list information from text randomly, or even in a linear fashion. Rather, they should depict the structure of knowledge in propositional statements that illustrate the relationships among the concepts in a map. A concept map consists of three basic elements:

1. Concept names written inside ovals, rectangles, or other shapes represent concepts.
2. Linking lines (as in flow charts) or arrows (as in arrow diagrams) show the connections between two concepts.
3. Linking phrases, which label linking lines, describe the relations between concepts.

Concept mapping is a learning strategy that can be expert, teacher and learner generated. Experts apply it to textbook, instructional or multimedia design, for example (Johnsen et al., 2000). Teachers can take advantage of concept maps to prepare e.g. lesson plans, teaching materials and learning aids. Learners can use it to represent

and organize information to be able to better understand and remember the subject under consideration (Chularut and DeBacker, 2004). For them, concept maps are aids to summarize subjects as well as support discussion and reflection. The more a learner binds concepts and examples together in a concept map, the deeper they can understand a subject (Baroody and Bartels, 2001).

The goal of the present study is to assess how much the two learning strategies concept mapping and note taking are suitable and efficient in the given primary school context as described below.

2. METHOD

2.1 Participants

The research was carried out with 135 students in three classes at grade 5 of Arif Eminoglu Primary School located in the District of Kayseri in Central Anatolia, Turkey. It was applied during the first half of the academic year 2002-2003 over a study period of 4 weeks. One control group with 41 students and two study groups with 48 and 46 students were randomly selected.

2.2 Materials

Chapter. The chapter "Getting to Know Our Body" in the course book "Science Curriculum for Elementary Students" (MEB, 1992) was studied.

Chapter Period. 24 lesson hours were given over a study period of 4 weeks (6 hours per week) corresponding to 4 units. For each unit, aims and objectives were established so that the data gathering for the assessment could be prepared.

Prior Knowledge. The Cognitive Entrance Behavior Test (CEBT) consisting of 28 multiple-choice questions and the Level Determination Test (LDT) with 52 multiple-choice questions were prepared. The CEBT was applied after selecting the control and study groups at the beginning of the 5 weeks training period (Figure 1), which proved that all groups had really been at the same learning level. The LDT was implemented as a pre-test at the beginning of the experiment (Figure 1). Of this test, 19 questions pre-tested knowledge, 18 questions comprehension, and 15 questions application. The samples of each type are shown in Table 4. Both tests have been deemed adequate with regard to scope and validity by a group of experts on the program itself in science and science education. The reliability coefficients of the instruments have been found as satisfying by using KR-20 formulae; 0.83 and 0.89 respectively.

Achievement Test. The same LDT was applied twice again as a post-test at the end of the study period of 4 weeks, and as a delayed post-test to measure recognition levels after 6 weeks (Figure 1). Both tests were checked and approved by a group of experts in science education.

Experimental Design. In this research the Control Group Pretest-Final Test type experimental design was applied.

Data Analysis. For this, a variance analysis was used. As the three groups were seen to be equal regarding their pre-learning status, the differences between their averaged post-test scores were examined to measure their recognition level. The same differences of the delayed post-test were analyzed to measure their recognition level again. Besides, the Scheffe Test (Pfaffenberger and Patterson, 1981) was applied to estimate group differences. .

2.3 Procedure

The following procedure was applied in this research. The 41 students of the control group continued their science course without any training on the learning strategies considered here. The 1st study group was educated in concept mapping (CM group), the 2nd study group in note taking (NT group) over a training period of 5 weeks as shown in Figure 1.

The 48 students of the CM started to work on concept maps prepared by the author in the beginning of the training period. Then they expanded the given concept maps to refine their contents. Afterwards, students were asked to create their own concepts maps both in a lesson and as homework, and then discuss the results with their classmates in class. Then they compared their own maps with the one prepared by the author. In time, students of the CM group became more skilled in making their own concept maps.

The 46 students of the TM group learnt to create note taking matrices, one of the note taking strategies. They were trained in a similar way as the students of the CM group. In the beginning they worked on note taking

matrices made by the author. After spending some time on their refinement, students began to prepare their own matrices both in a lesson and as homework that were then discussed in class. Then they evaluated their own matrices using the one created by the author. In this way, students of the TM group learnt how to produce matrices for note taking.

Both study groups were tested at the end of the training period after completing small projects on concept mapping and note taking, respectively.

3. RESULTS

As shown in Figures 2 illustrating the data of Table 1, no significant differences exist for the pre-test scores between control and study groups gained through the LDT, which was applied at the beginning of the study period (Figure 1). Thus, the CEBT results were confirmed that all groups were equally selected with regard to their pre-study level.

Figure 2a. Pre-test scores of control and study groups
Figure 2b. Post-test scores of control and study groups
Figure 2c. Delayed post-test scores of control and study groups

Table 1. Test scores of control and study groups
(M = Mean value, S = Standard deviation, N = Number of students)

Comparing the control and CM pre- and post-test scores (Figure 2a and 2b), one observes that there is hardly any difference between their scores. The same is true for the post- and delayed post-test scores (Figure 2b and 2c), meaning that concept mapping had no visible effect on the CM group in this experiment.

Doing the same for the NT group, a significant difference is recognizable for the post-test knowledge score (Figure 2b), and the delayed post-test knowledge and application score (Figure 2c). These results are confirmed by the F-values of the variance analysis (Table 2) and the difference values of the Scheffe tests (Table 3). Thus, one can conclude that note taking matrices had a positive impact on the NT group in this experiment.

Table 2. F-values of variance analysis for different LDT categories
(Largest F-values in bold without considering the Total)

Table 3. Scheffe tests for control and study groups
(D = Difference, S = Standard deviation, p = probability factor)
(Largest D-values in bold without considering the Total)

4. DISCUSSION

Considering the gained results the main question is why the CM study group did not do significantly better than the control group in their post- and delayed post-tests. The following reasons or a combination of them may provide an answer:

1. Teaching of concept mapping was not sufficient in terms of quality and quantity.
2. Students of the CM group didn't learn concept mapping in depth because it's much harder to understand and apply than note taking, especially for 5 graders (comp. Johnsen et al., 2000).
3. The acquired CM knowledge was not giving any advantage for the post-tests because they only consisted multiple-choice questions students couldn’t apply their CM knowledge to.

In the opinion of the author the first two reasons played more important roles, and discussions with students of the CM group after the experiment confirmed this. Of course, other factors are also involved, for example, the fact that the time period set aside for carrying out the experiment with training and study periods may be insufficient to produce the expected effects.

5. CONCLUSIONS

The goal of this work was to assess how much the two learning strategies concept mapping and note taking are suitable and efficient in the context of a Turkish primary school. Obtained results from the experiment indicate that note taking can help students to improve their levels of knowledge and maybe application. But this is not the case for concept mapping, where no significant differences between control and study groups were observed. This is quite unsatisfactory and needs further reseach with various grade and subject levels over a longer study period in order to gain more insight and identify the real reasons.

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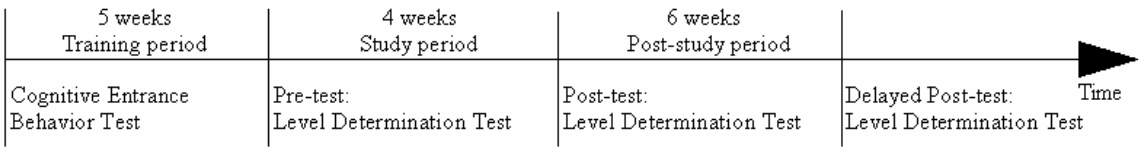

Figure 1. Time plan with periods/tests located above/below the time axis

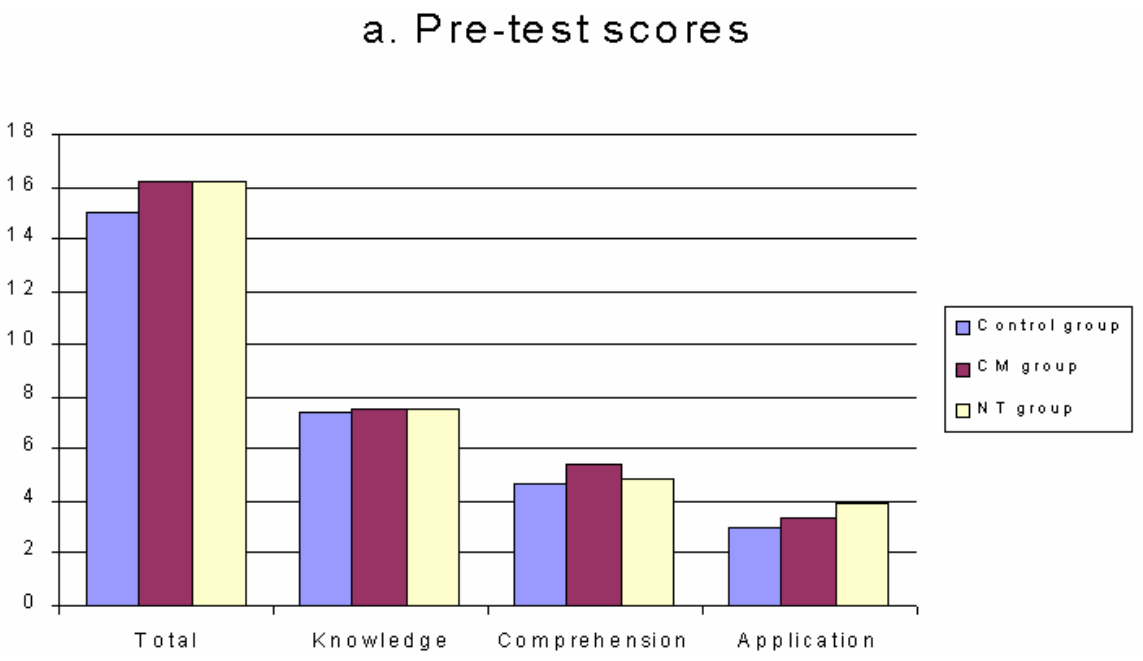

Figure 2a. Pre-test scores of control and study groups

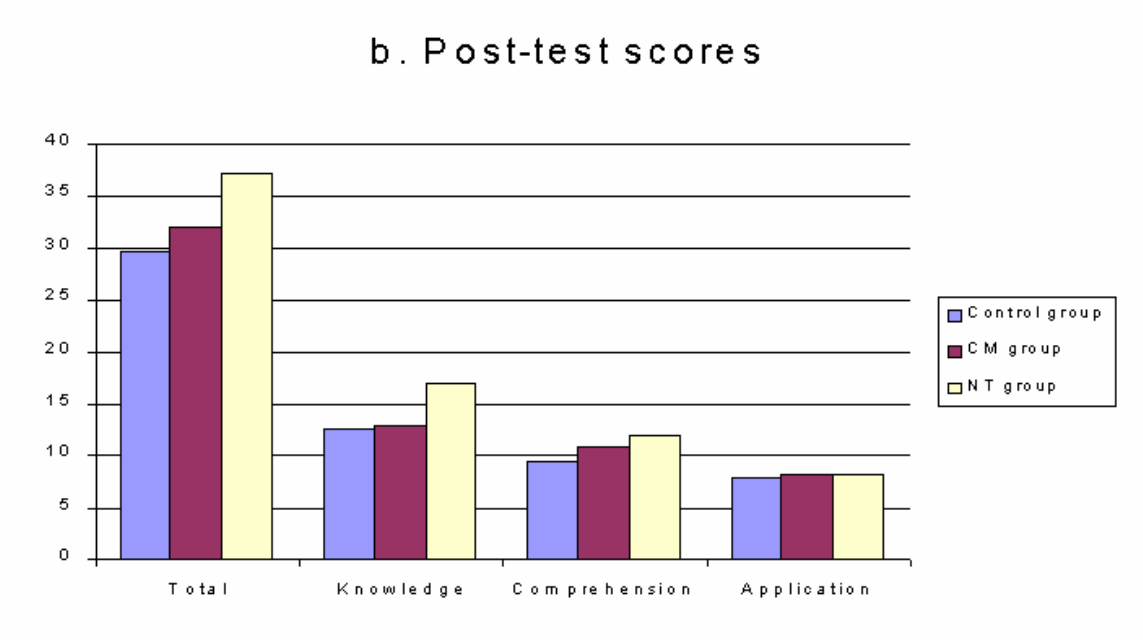

Figure 2b. Post-test scores of control and study groups

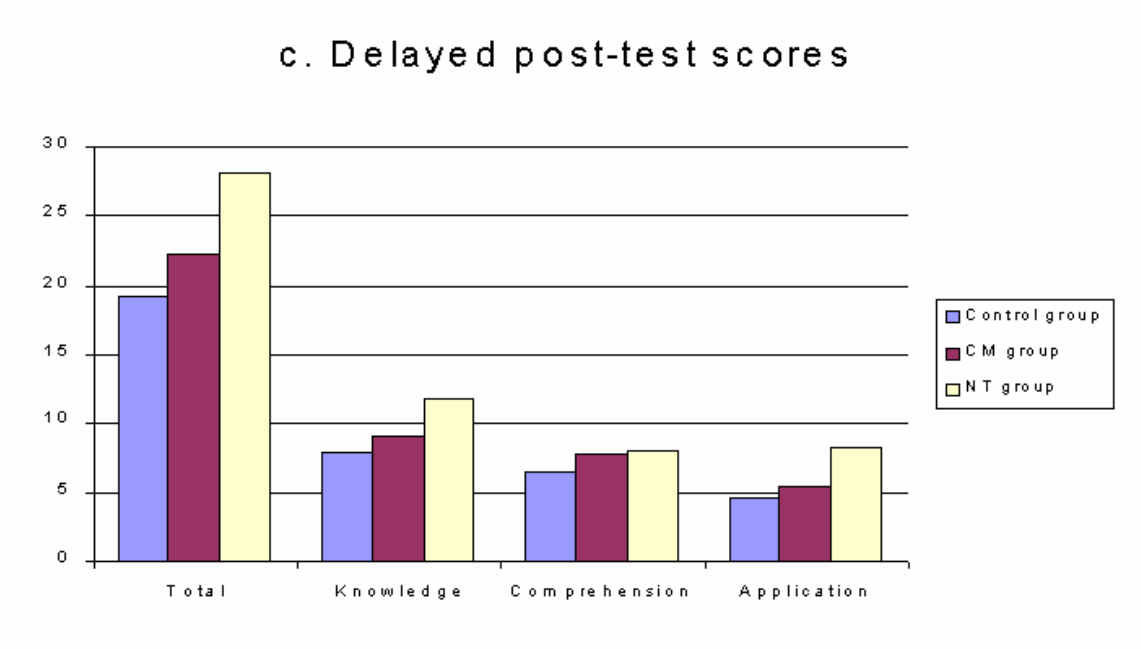

Figure 2c. Delayed post-test scores of control and study groups

Table 1. Test scores of control and study groups
(M = Mean value, S = Standard deviation, N = Number of students)

Group		N	Pre-test		Post-test		Delayed post-test	
			M	S	M	S	M	S
Control	Total	41	15.019	3.791	29.780	5.332	19.171	5.572
	Knowledge		7.415	1.975	12.537	2.501	7.927	2.553
	Comprehension		4.634	2.022	9.415	3.082	6.537	2.829
	Application		3.000	1.844	7.829	1.787	4.707	1.965
CM	Total	48	16.208	5.061	31.98	7.50	22.333	6.155
	Knowledge		7.542	1.967	12.896	3.520	9.125	2.900
	Comprehension		5.375	1.996	10.938	2.740	7.792	2.767
	Application		3.333	2.309	8.146	2.484	5.417	2.172
NT	Total	46	16.261	5.331	37.171	3.349	28.109	5.030
	Knowledge		7.478	2.383	17.022	1.374	11.826	2.831
	Comprehension		4.870	2.083	12.000	1.606	8.087	2.336
	Application		3.913	4.896	8.152	1.897	8.196	1.655

Table 2. F-values of variance analysis for different LDT categories
(Largest F-values in bold without considering the Total)

	Total	Knowledge	Comprehension	Application
Pre-test	0.867	0.040	1.566	2.300
Post-test	19.66***	**40.37*** **	11.326**	0.332
Delayed post-test	28.67***	**22.90*** **	4.133*	**40.13*** **

*p < .05 **p < .01 ***p < .001

Table 3. Scheffe tests for control and study groups
(D = Difference, S = Standard deviation, p = probability factor)
(Largest D-values in bold without considering the Total)

Differences of post-test results				
Total	Comparison	D	S	p
	Control / CM	2.199	1.2113	>.05
	Control / NT	7.394***	1.2234	< .001**
	CM / NT	5.195***	1.1753	< .001**
Knowledge	Comparison	D	S	p
	Control / CM	.3592	.5607	>.05
	Control / NT	**4.486*** **	.5663	< .001**
	CM / NT	**4.126*** **	.5440	< .001**
Comprehension	Comparison	D	S	p
	Control / CM	1.523	.5392	>.01
	Control / NT	2.586***	.5446	< .001**
	CM / NT	1.063	.5232	>.05
Application	Comparison	D	S	p
	Control / CM	---	---	---
	Control / NT	---	---	---
	CM / NT	---	---	---
Differences of delayed post-test results				
Total	Comparison	D	S	p
	Control / CM	3.163	1.194	>.01
	Control / NT	8.938***	1.206	< .001**
	CM / NT	5.776***	1.158	< .001**
Knowledge	Comparison	D	S	p
	Control / CM	1.198	.5902	>.05
	Control / NT	**3.899*** **	.5961	< .001**
	CM / NT	**2.701*** **	.5762	< .001**
Comprehension	Comparison	D	S	p
	Control / CM	1.255	.5632	>.05
	Control / NT	1.550*	.5688	< .05*
	CM / NT	.295	.5464	>.05
Application	Comparison	D	S	p
	Control / CM	.709	.4136	>0.05
	Control / NT	**3.488** **	.4178	>0.01**
	CM / NT	**2.779***	.4013	<0.01**

*p < .05 **p <.01 ***p <.001

Table 4. Level Determination Test Samples for each type.

LEVELS	NO	QUESTION
KNOWLEDGE	3	Which of the following is not the task of a skeleton? a.) Protects the inner organs b.) Shapes the body c.) Helps the inner organs to work d.) Helps the body movements
COMPREHENSION	28	Ali says 'I can have the blood transfer from all people but I have no Rh in my blood'. What is the blood type of Ali? a. 0 Rh (+) b. AB Rh (+) c. 0 Rh (-)

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<tr><td></td><td></td><td>d. AB Rh (-)</td></tr>
<tr><td>APPLICATION</td><td>47</td><td>
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<tr><th></th><th>BLOOD TYPE</th><th>Rh</th></tr>
<tr><td>Ali</td><td>0</td><td>+</td></tr>
<tr><td>Veli</td><td>AB</td><td>-</td></tr>
<tr><td>Ömer</td><td>A</td><td>+</td></tr>
<tr><td>Kaya</td><td>B</td><td>-</td></tr>
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According to the table above, which following is incorrect?

a. Ömer can have the blood tranfer from Ali
b. Veli can have the blood transfer from Kaya
c. Kaya can have the blood transfer from Veli
d. Ali can never have blood transfer from the others
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