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A COMPARISON BETWEEN CONCEPT MAPS AND A METHODOLOGY COMMONLY USED IN PANAMANIAN ELEMENTARY SCHOOLS BASED ON QUESTIONNAIRES

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Abstract. The *República de Guatemala* School in Panama joined the Conéctate al Conocimiento Project in 2006. Since then, concept maps are being used in the school to promote more meaningful learning experiences among students. Some teachers, however, have doubts as to whether this methodology is appropriate for subjects that involve a great deal of factual information, as is the case in many humanities classes. In subjects such as these, teachers generally prefer to use "questionnaires" a methodology that allows them to cover, in the limited amount of time usually allotted to these subjects, the voluminous amounts of content mandated by the Ministry of Education programs. The experience presented in this poster constitutes an effort by three teachers to compare the benefits of using concept maps versus the traditional questionnaire approach in the area of Social Sciences. Results of three tests applied to the students indicate that the groups working with concept maps obtained on average greater than or equal scores as those using the questionnaires; the variability in the concept map groups in each case was lower. Aside from the actual scores, participating teachers noticed that the responses of students using concept maps tended to be deeper or more thoughtful than those of students working with questionnaires. This study has helped to convince teachers at this school of the usefulness of concept maps.

1 Introduction

Our school the *Escuela República de Guatemala*, joined the Conéctate al Conocimiento Project in 2006. As a part of this program, teachers of 4th, 5th and 6th grade were trained to use concept maps as a way to bring about better learning experiences for our students. Concept maps were developed by Dr. Novak over 30 years ago. A concept map is a graphic resource "intended to represent meaningful relationships between concepts in the form of propositions" (Novak & Gowin, 1984, p. 15). They have their origin in David Ausubel's theories about the psychology of learning, stated during the 60's.

Instructional strategies commonly used in Panama focus on students learning facts, but seldom help students to really understand, or allow them to learn how to *learn*, much less, to develop fully, and learn how to *be*. In most educational centers in our country, students are required to pay attention and memorize; specific tasks involve listing, enunciating, enumerating, defining, describing, summarizing. We can point out that the kinds of actions reflected by these verbs belong to the lowest level in Bloom's (1956) Taxonomy. Teachers who resort to strategies that call upon only these tasks are requiring little from their student in terms of cognitive effort, and thus are hindering students' potential for constructing their own knowledge.

A frequent problem we teachers encounter is to determine the most appropriate technique or strategy to help a group of students learn a given curricular content. One teaching strategy commonly used in Panamanian elementary schools involves "questionnaires." This teaching strategy tends to be used for subject matter in which a large amount of factual material needs to be covered in the course of a school year, as is the case with most of the humanities. By "questionnaire" we mean a teaching strategy in which the teacher gives his or her students a set of questions (mostly closed questions, but sometimes open ones are included as well) for them to answer. Students may then work individually or in small groups to find the correct answers to these questions. After answers are checked by the teacher, the best ones are selected and are taken down by everyone. Students then use these questionnaires to study from, as tests are based on them.

Since 2006, when our school entered the Conéctate Project, several of teachers began to consider and to experiment using concept maps as an alternative teaching-learning technique for a number of different subjects, including areas with much detailed information such as social sciences. However this led to a controversy as to whether this technique was suitable for this subject. Some teachers believed concept maps would not serve well with the large amounts of content involved, since the time required in creating the concept maps would not compensate for any benefits that might result.

This debate led to the present study. In it we set out to compare the effectiveness of concept maps, as compared to questionnaires, as techniques for to help students learn the curricular content. Specifically, we were interested in comparing these learning tools in the context of the 5th grade social science curriculum, the content of which is dictated by Panama's Ministry of Education.

2 Methodology for the study

The present study was carried out at the *Escuela República de Guatemala*, an urban elementary school located in the province of Panama, in the Republic of Panama. It has a student body of 701 students, served by 34 teachers. The study used as sample one of several 5th grade classes. The group had 30 students, and was divided into two equal sized groups, group A and group B. The homeroom teacher formed these groups by choosing alternate names from the enrollment list. Two different topics were studied: "The Organs of the Panamanian State" (topic 1), and "Pre-Hispanic period" (topic2). Both topics are considered to be rather lengthy and detailed. Topic 2, however, is somewhat longer, and probably less familiar to students.

For topic 1, group A worked in their regular classroom, with their homeroom teacher, using the questionnaire methodology; while group B worked in the innovation classroom, a special room equipped by the Conéctate Project (Tarté, 2006), using the concept map methodology implemented through the CmapTools program. The work was directed by the coordinator of the innovation classroom (CAI). One week was devoted to the subject. Once the topic had been covered, students took a test on this material (test 1).

Subsequently, a similar scheme was carried out for topic 2. The main difference was that the groups were inverted: this time group A worked with concept maps in the innovation classroom and group B worked with questionnaires in the regular classroom. A total of 2 weeks was dedicated to this topic. Afterwards a test on this material was applied to both groups (test 2).

Finally, in order to measure knowledge retention, a third test was given two and a half months later. This test covered only the material of topic 1, "The Organs of the Panamanian State." Questions were based on the content of the questionnaire as well as the concept map. Students were not warned previously that they would be taking this test (test 3).

The use of **questionnaires** in the regular classroom was as follows:

- Homeroom teacher provided questions on the topic. Questions were both closed and open.
- Students organized themselves into teams of 3 students (a total of 5 teams), to complete the questionnaire.
- Students read material indicated by the teacher.
- Answers from different teams were discussed with the guidance of the teacher.
- Best answers to the closed questions were chosen. All students copied down these answers.

The use of **concept maps** was as follows:

- The CAI directed a brainstorming session with all students.
- Students read the same material as students in the regular classroom.
- Together students formulated a focus question and identified the main (root) concept for the map.
- Students looked up additional information on the topic on the Internet.
- Guided by the CAI, a group concept map was created, based on the content of the assigned reading, the brainstorming session, and the information gathered from the Internet.

3 Results

Tables 1, 2 and 3 show the results of tests 1, 2 and 3, in that same order. The statistics in table 4 summarize the results from the other three tables; they show that in spite of the differences, the only significant difference was the first one.

Topic 1: "The Organs of the Panamanian State"					
	Group A (Questionnaire)			Group B (Concept Map)	
	Student grade[1]	Number of students	Percentage of students	Number of students	Percentage of students
Test 1 (50 points)	1.0 - 1.9	1	6.7%	0	0%
	2.0 - 2.9	5	33.3%	0	0%
	3.0 - 3.9	4	26.7%	2	15.4%
	4.0 - 4.9	3	20.0%	11	84.6%
	5.0	2	13.3%	0	0%

Table 1. Results of test 1.

Topic 2: "Pre-Hispanic Period"					
	Group B (Questionnaire)			Group A (Concept Map)	
	Student grade	Number of students	Percentage of students	Number of students	Percentage of students
Test 2 (50 points)	1.0 - 1.9	0	0.0%	0	0.0%
	2.0 - 2.9	5	33.3%	0	0.0%
	3.0 - 3.9	3	20.0%	5	33.3%
	4.0 - 4.9	4	26.7%	9	60.0%
	5.0	3	20.0%	1	6.7%

Table 2. Results of test 2.

Topic 1: "The Organs of the Panamanian State"					
	Group A (Questionnaire)			Group B (Concept Map)	
	Student grade	Number of students	Percentage of students	Number of students	Percentage of students
Test 3 (50 points)	1.0 - 1.9	1	6.7%	0	0.0%
	2.0 - 2.9	3	20.0%	2	13.3%
	3.0 - 3.9	4	26.7%	7	46.7%
	4.0 - 4.9	4	26.7%	5	33.3%
	5.0	3	20.0%	1	6.7%

Table 3. Results of test 3, applied two and a half months after test 2.

	TEST 1		TEST 2		TEST 3	
	Questionnaire	Cmap	Questionnaire	Cmap	Questionnaire	Cmap
Mean	3.5	4.3	3.8	4.2	3.8	3.8
SD	1.2	0.4	1.4	0.4	1.5	0.7
Comparison	Significant (P = 0.03)		non-significant		non-significant	

Table 4. Means, standard deviations and statistical significance of comparison for each of the three tests.

[1] In Panama, grades range from 1.0 at the low end, to 5.0 at the high end. Grades below 3.0 indicate failure.

4 Interpretation of the results

It is interesting to notice certain aspects of the grade distributions shown in the tables. For example, the percentage of failures for students using concept maps was always lower than for students using questionnaires. In fact, in the first two tests the percentage was 0%. This is important, since one as teacher is always looking for strategies that help reduce student failure. On the other hand, in the concept map group more students were concentrated in the higher grade ranges. The results we got for concept maps are similar to those obtained by Rodriguez & Coloma (2006), where they found that when using concept maps, the grades of the class became concentrated in the upper ranges, with no failures.

Perfect scores (5.0), though, were more frequent in the questionnaire group. We believe this may be a reflection of the fact that these students studied from a questionnaire, which would have been very similar to the test format. Students learning with concept maps did not have this advantage.

We noticed also that the answers of students from the concept map groups seemed deeper, more substantial. We can not be sure that this was due to the maps themselves, though, since it could also have been a reflection of their use of Internet, which provided them with additional information compared to the other group.

Finally, in table 3 we have the results from the third and final test, given two and a half months after the second test. Overall, the distribution in the questionnaire group remained similar to the previous two tests, but the concept map group shows much more variation, including some students in the failure region. Nonetheless, there is still less variability than in the questionnaire group.

One other thing strikes our attention. Why, if the concept map groups had higher average scores (and lower variation) on the first two tests did this change on the final test? Why did the two groups even out? We think this might be because the concept maps were created as an entire group. This means that not everybody worked or thought as hard. In the questionnaire group, students worked in small teams of 3.

Another thing is that even though the concept map students looked up and discussed additional information, much of it was not placed in the concept maps (the CAI made sure the content of the maps was the same as that of the students using questionnaires). Even so, after two months and a half, students using concept maps knew as much as students using questionnaires, which is what we had set out to show.

5 Conclusions

In Panama, some educators think concept maps may not be an appropriate tool to study subjects with a great deal of detailed content. They feel that the amount of time it takes to construct concept maps does not justify their possible benefits. They prefer strategies like questionnaires, which, in our opinion, are more inclined to promote learning by memory. Our study, though it had methodological limitations, shows that this is not the case. Taking the same amount of time, students using concept maps performed as well or better than students using questionnaires.

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