

## THE RELATION AMONG CMAPS, TEACHERS AND THEIR PEDAGOGICAL PRACTICE

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**Abstract.** Concept maps have been used more and more frequently in the pedagogical context. (Dutra, 2004, Moreira 1997). This work, though, aims to investigate the relation between teachers and concept maps. To do so, we have elaborated three workshops for teachers from State schools in the state of Rio de Janeiro, Brazil, in different occasions and different schools. In order to assess such relation and to have a Figure of the teachers' profiles, we analyzed concept maps made by the teachers with lose concepts and then with texts, teachers' audio and video recordings and questionnaires. The results indicate the need of more time to concept maps teaching and to the continued formation of teachers not only to prepare them for the use of this tool but also to raise reflection about their system of beliefs about the learning-teaching process.

### 1 Introduction

Concept maps are a powerful tool to knowledge construction and learning enhancement (Novak, 1984). They are used in different situations and in many environments. Within these environments, education is one of the areas which can get great benefit of this tool (Moreira, 1997). Concept maps play a fundamental role in the learning process, for many reasons. Thus, for students to learn concept maps and how to use them, teachers learn how to use them. Following the same line of research - teacher development using concept maps (Dutra et al., 2004; Abrams, 1999; Moreira, 1997) - we gave workshops to Brazilian teachers in 2009 and 2010. The motivation for this work arouse from the need of knowing how teachers apprehend CMap use, its applicability and viability within the Brazilian educational context, i. e., how they feel in relation to the use of this tool with their students. This research provided data for empirical studies in order to make a diagnosis of teachers' learning-teaching beliefs and how such beliefs perpetuate in these teachers' pedagogical practices.

### 2 Methodology

#### 2.1 *The workshop*

We've developed three workshops with teachers from state schools from the State of Rio de Janeiro, Brazil. Each workshop occurred in different schools with different teachers and using different texts, in the years of 2009 and 2010. All three workshops were part of the official school year and lasted about 2 hours each. There was an average of 20 teachers in each workshop. Most of them worked in junior high and high school classes at the time. The workshops had 6 phases: explanation, concept map construction with lose concepts, debriefing, concept map construction using texts, debriefing and general discussion. In the 1<sup>st</sup> phase we explained the CMaps, their fundamentals and showed some examples. In the 2<sup>nd</sup> phase, teachers were divided into groups to build their own maps with lose concepts. Each group had concepts written in small paper rectangles and a card board. In the 3<sup>rd</sup> phase, each group explained their maps to their colleagues and the whole group discussed the organization of each map. In the 4<sup>th</sup> phase, teachers were again divided in groups to build maps from texts previously chosen. Each group received a text and the corresponding CMap with some concepts filled; they should complete the missing concepts. In the 5<sup>th</sup> phase, teachers again discussed about the maps with the whole group. Last, they discussed about the maps and how to use them in the classroom.

#### 2.2 *Data collection and analysis*

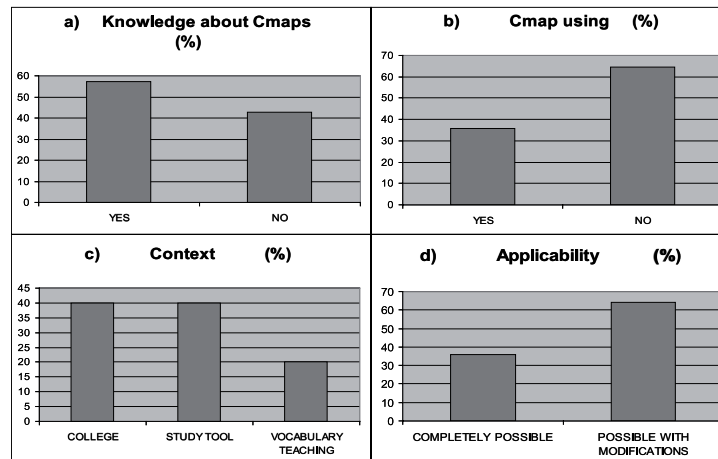
The data were collected using video and audio recordings, the teachers' maps and questionnaires with multiple choice and open questions filled in at the end of the workshop. The data collected from the questionnaires have been put in graphics for quantitative analysis. A qualitative approach was taken from the audio and video data and teachers' maps analysis.

### 3 Results

The results are presented as follows: in 3.1, we provide data collected from questionnaires and the teachers' speech. In 3.2, we also present some of the teachers' speech, and sketches from some of the teachers' maps.

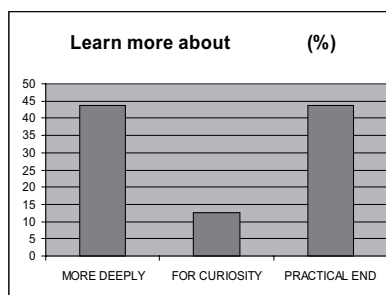
#### 3.1 Data based on teachers' questionnaires and speech

Figure 1 shows data about the teachers' knowledge of CMaps, their use, the context they would be used and their applicability.



**Figure 1.** a) have you known about CMaps? b) Have you used CMaps? c) Context of using CMaps; d) Is this applicable to your pedagogic practice?

Figure 1a shows that 64% of the teachers know about concept maps. However, only 36% said to use or to have used CMaps (Figure 1b). Figure 1c shows that 40% of the teachers said to have used CMaps in college, 40% as a study tool and 20% in a specific situation. Results show that a very small part of teachers use CMaps in their daily life. Most teachers who use CMaps (64%) pointed out the need of modifications (Figure 1d). There's a narrowing in the sequence of graphs in Figure 1, already expected. But what calls the attention is the use of CMaps by a very small percentage of the teachers. It signals that they aren't prepared to use CMaps or, because of their professional education, they don't feel confident to do so. The fact that most teachers have proposed changes in the maps show that they're aware of the need of adapting CMaps to specific situations. Figure 2 shows willingness to learn more about CMap: 43% of the teachers said they'd like to learn more deeply about CMaps, 44% with practical end. Only 13% would study for curiosity.



**Figure 2.** Would you like to know more about CMaps?

Most teachers showed interest in learning more deeply about CMaps or their practical use: "This map is like that: first you have to know a lot". Teachers seem to have understood dichotomy between the theoretical study and practical application of the CMaps. Figure 3 shows the teachers' needs of modification to CMaps to different situations.

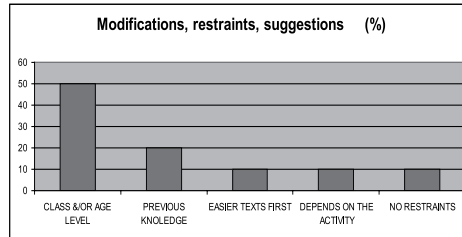


Figure 3. What kind of modifications, restraints and suggestions would you have to add?

Only 10% of the teachers showed no restraints in relation to CMap use. But the great majority pointed out the need of adequacy of CMaps. Figure 3 also shows that 20% of teachers have restraints in relation to previous knowledge and 10% in relation to the level of difficulty of the texts. We have then 30% of teachers who understand that cognitive adequacy is necessary. Still, a very small number of teachers associate previous knowledge to CMap adaptations. Most of them (50%) showed the need to adapt the CMaps to class or age level. This suggests that most teachers understand the importance of considering the cognitive maturity of their students. Despite the concern about the adequacy of concept maps, only 20% of the teachers see the need of previous knowledge to make CMaps. This shows the teachers' difficulty correlating CMaps with what the student already knows. Figure 4 shows the teachers' answers related to other uses of CMap.

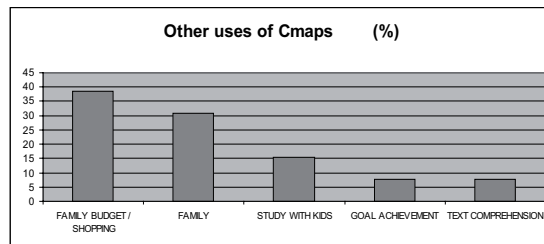


Figure 4. How would you use CMaps apart from the pedagogic usage?

In relation to other uses of CMaps, they were pointed out for family budget or shopping by 38% of teachers; 31% indicated the possibility to use CMaps with their family and 15% would use CMaps to study with their children. Goal achievement, and work with text were pointed out for 8% of the teachers. The last information is especially relevant as it signals that teachers are not able to correlate text comprehension and hierarchization.

### 3.2 Sketch from teachers' maps, and teachers' speech

We present here two parts of some of teachers' maps in the form of sketches. Teachers' discourse corroborates the maps. The analysis of teachers' first CMaps shows some relevant misconceptions. Figures 5 and 6 show examples of teachers' mistakes in hierarchy (Figures 5a and 6a) and the corresponding proper hierarchizations of the concepts (Figures 5b and 6b).

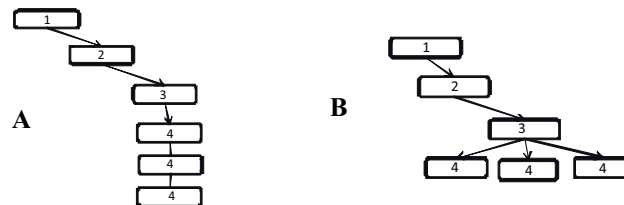


Figure 5. Sketch of part of a CMap made by the teachers: A) fail in the arrangement of concepts; B) proper arrangement.

Figure 5a shows lack of understanding in hierarchization. The teachers organize the concepts properly until the third level. However, the elements from the last level are subordinated to each other in a linear sequence.



**Figure 6.** Partial sketch of a CMap made by the teachers: A) misplacement of the concepts; B) correct arrangement.

Figure 6a presents another hierarquization difficulty: the concepts no 4 should be below the concepts no 3, as in Figure 6b. The teachers were able to hierarquize concepts up to the 2<sup>nd</sup> level. One of the teacher's speeches reinforces the misconceptions seen in the maps: "I think that deep inside we may even know, but we must arrange it in some way, organize the thought, make a little research (to) organize that puzzle in our mind". The teacher's discourse closes with the conclusion that "the brain already has the map ready". This shows that a lot of effort and study must take place in order to undo such misunderstanding.

#### 4 Discussion

CMaps have shown to be an efficient tool to teachers' education (Dutra et al., 2004), with consistent results. However, a more solid discussion about the relation between CMap and teachers' education is quite necessary. And, assuming that very few teachers would use CMaps for professional of individual issues, they are not prepared to use CMaps in the classroom.

During the intervention, it was possible to notice some other inconsistencies, which were solved, at least partially, as the workshops proceeded. There was inappropriate dichotomy between conceptual knowledge of CMaps and its application in pedagogical practice. Such dichotomy points out to a fragmented teaching formation, which does not favor teacher development. There was also a general agreement on the similarity between CMaps and synoptic tables, as the purpose of the last is to classify concepts and not to establish relationships and hierarchy among them (Moreira, 1997). Nevertheless, such misconception has changed along the workshops. The teachers showed deeper understanding about CMaps and their important role in promoting meaningful learning (Moreira, 1999). The teachers' difficulty in organizing thought, shown in figures 5a and 6a, may be a reflection of the rote learning to which they were submitted. Rote learning, thus, is part of their system of beliefs. And, as one of the most important characteristics on a system of beliefs is the capacity of influencing behavior (Leite, 2003), such system influences pedagogical practices (Barcellos, 2001 *apud* Leite, 2003).

Despite the teachers' challenges during the workshops, due, mainly, to their system of beliefs rooted in their professional practice, it became patent that their knowledge of concept maps showed new ways to promote significative changes in their teaching. The teachers' interest in learning more about CMaps rose. Also, many of them found out how crucial it is to learn and to teach meaningfully due of their experience the workshops. And, because of their experience during the workshops, most teachers found out how crucial it is to learn and to teach in a meaningful way. Obviously, the amount of time available wasn't by far enough to show all the range of possibilities of work with CMaps, which should be part of teaching formation. And that's one aspect of how the study can be generalized to other environments, within the educational field: the use of CMaps as a teaching tool should be part of teachers' academic life. Concerning school curriculum development, institutions (universities and schools) should address more attention on "how" to teach than "what" to teach (Novak, 1984), and CMaps can contribute significantly to this process. We believe that, if the intervention could be widened to other environments, such as the ones cited above, there would be not only teachers and students learning in a meaningful way, but also citizens in general learning to think, and to act meaningfully.

#### 5 Summary

The aim of this work was to investigate the relation between the teachers and CMaps. For such, we've elaborated three workshops for teachers of state schools in Rio de Janeiro, Brazil, in different moments and schools. The study was

divided in 6 phases: explanation, concept map construction with loose concepts, debriefing, concept map construction using texts, debriefing and general discussion. We also used questionnaires, audio and video recordings to assess teachers' knowledge, as well as the applicability of the maps. Data analyses signalize the need of study of CMaps and the reflection about the learning-teaching process, which still favors memorization to the detriment of meaningful learning. As teachers showed willingness about CMap learning, we believe it's possible to start changes in the pedagogical field.

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