Concept Maps: Making Learning Meaningful
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# PEDAGOGICAL ORIGAMI: CONCEPT-MAPPING AND FOLDABLES A KINAESTHETIC AND 3D APPROACH TO CONCEPTUAL STRUCTURE

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**Abstract.** Concept-maps and foldables, a 3D interactive and manipulative organizer, have been united to increase motivation, commitment and performance in different subject matters. Foldables enable the concept-mapper to organize knowledge and processes and represent them in a three dimensional fashion. This manipulative approach has been used at the primary and secondary levels with a positive result on learning and motivation which involves minds-on and hands-on activities. The present paper does not boast a methodological research but an examination of the links between foldables and concept-mapping as applied in a classroom in the 3rd grade French, grade 7 sciences, and in grade 10 math.

## 1 Introduction

In my 30 years practice as teacher and pedagogical counsellor I have noticed that students increasingly need to literally manipulate knowledge. In some countries, rote learning is being slowly replaced by a more practical, meaningful learning approach (Ausubel, 1963; Québec Education Program, 2007). To acquire knowledge and develop lifelong competencies, educators have to adapt their teaching methods to the main learning methods and modalities of their learners.

We have noticed that for young learners and students with learning difficulties, it is important to immerse them in situations which enable them to move, manipulate, express their emotions, and choose different materials and organize their knowledge in such a way as to create a more permanent mark in their brain.

## 2 Theoretical references

Below we will briefly establish our theoretical framework in which we will present our definition of concept-maps and of the process of foldables as used in an information organizing setting.

### *2.1 Concept-mapping*

Concept-mapping is a process during which a designer brings together knowledge concerning a main topic and establishes links with one another. In this way, she organizes information in such a way as to permit a more durable imprint and help in solving problems (Okebukola, 1992). According to Novak (1990), a concept-map is a schematic tool which organizes information. Information is organized and/or retrieved to enable the user/concept mapper to better understand processes or knowledge.

A concept-map includes concepts, links, hyperlinks and link propositions (Patry, 2004; Novak & Gowin, 1984). It is more a cognitive tool than a metacognitive one (Patry, 2004) which act mainly as an organizer. There are different types of schematic organizers such as mindmaps, clustermap, etc.. (Patry, 1998). Concept-mapping per say involves identifying key concepts. The concept-mapper must seek to understand the underlying concepts in her map. Otherwise, the whole map's meaning can be faulty and cause structural, conceptual, and reading problems. Every concept is understood through its relationships with other significant concepts (Fisher, 1990). Then it is important to create categories with these concepts which will later be structured according to hierarchies started from the most inclusive to the most exclusive ones. Links are established with link propositions which define the relationships between concepts. Without listing exhaustively, past researchers have demonstrated the effects on performance and motivation of concept-mapping. The students remain more focused on the task (Trochim, 1996). Concept-maps make better problem solvers (Okebukola, 1992).

### *2.2 Foldables as three dimensional graphic organizers*

Foldables act as 3D graphic organizers. Some may call the process as paper folding. It could be call also Pedagogical Origami. As with concept-mapping they work on motivation and render learning meaningful. Manipulatives are not new to the learning arena. Some have been used since the nineteenth century and even included in the curricula in the 1930s (Sowell, 1989). Dinah Zike (2003) has done extensive work on these manipulatives.

A foldable is created by bringing together concepts of interest, arranging them in such a way as to demonstrate links in a 3D fashion as opposed to the 2D manner of a concept-map.

Foldables contain as few as one concept to as many as dozens. The goal is to organize the information, to enable the user and designer to access rapidly the information. The process by itself resembles the one in concept-mapping. On the other hand, concepts are linked together in more dimensions.

Colors, images, pictograms, and shapes enrich the foldable in such a way as to bring about interest in the designer/user/reader. '*Foldables help students focus on and remember key points without being distracted by other print.'*(Zike, 2003, p.1). Foldables can be used for assessment, self-assessment as well on top of organizing information.

To construct a foldable, one identifies the key concept(s) to be organized or demonstrated. Afterward, there are many shapes and folds which can be used to display the concepts such as the Taco, Hamburger, Hot Dog, Burrito, Shutter, Valley, and Mountain folds (Zike, 2004). The fold(s) selected and the number of parts depend on the number of subcategories and hierarchies one needs to display. They may be stored in protective sheeting in a binder or adapted in a notebook (Zike, 2008).

According to Sowell (1989), a meta-analysis of 60 studies has demonstrated an increase in mathematics achievement with long-term use of such tools. On other hand, Boakes and Stockton (2009) have found that combining paper folding and maths learning are *'as beneficial as traditional instruction in building an understanding of geometric terms and concepts, though the approach affects the spatial ability of males and females differently'* (p.1). Foldables influence positively the affective and cognitive areas (Casteel & Narkawicz, 2006). These researchers have found that there was an improvement in the students' attitudes toward their work. We have noticed in class that our students have a tendency to become more intellectually engaged while in the process of constructing a foldable.

Such a tool can be used across the curriculum. Every subject can be involved in foldables such as concept-mapping. Olson (1975) has used extensively paper folding in geometry with some measure of success. Many current math teachers act as well.

### *2.3 Combining concept-maps with foldables*

Conceptually both these tools, concept-maps and foldables, are similar in as such as with information/knowledge/concepts, they organize, are schematic tools and are representations of how the designer perceives them. To construct a concept-map and a foldable you have to manipulate concepts, create categories and hierarchies, and establish links between concepts. They encourage the learner to design his own and ideas. Also they motivate the teacher to model their application.

The main differences between them are in their dimensional arena. Concept-maps are more 2D whereas foldables are 3D.

The construction of both tools, the concept-map and the foldable, depends on the 'designer', her life's experience, her knowledge, her motivations. Constructing these tools is holistic in such a way that the individual touches globally his knowledge and experience.

## 3 Application

We have introduced foldables as a tool for concept-map in classes from the primary and secondary levels. No tests

or official research have been administered. We will cite below how these foldables/concept-map have been applied in theses classes. Every time we have used foldables/concept-maps we have noticed that we need to model the construction. Not all students perceive folding and concept arrangements de same way.

### *3.1 At the primary level*

A teacher in the grade 3 level has applied the foldables in subject matters such as in French (for grammar and verbs), and in math (for multiplication and number reading). Her students have been enthusiastic and were always ready to create a new foldable either before the introduction or at the end of the presentation of a new concept. At first, it was difficult to get them to fold the paper as demonstrated. Slowly they caught on and created documents that synthesized the information and were references for applying processes.

### *3.2 At the secondary level*

During fall 2008, foldables have been introduced first in a Science and Technology class at the grade 10 level. Processes such as the scientific inquiry and knowledge about the atomic model had been difficult in acquisition using the traditional rote learning approach. Once presented in a foldable way, students were at first dubious and thought of such a way of working as beneath their age level. It was for kids. Quickly, the students used the foldables as quick reference documents.

It was during fall of 2009, that a 10th grade math teacher came to me, discouraged and searching a way to have her students better understand the different concepts and processes they need to master. They were attending a math course named Culture, Society, and Techniques. They are students with learning and motivation difficulties. Their latest exam had produced a 35% average. Together we worked on foldables which could be used by them. They had the same reaction as my students from last year. But their average increased significantly.

The same processed occurred for a Science and Technology teacher in 7th grade. Students, as with the others, enjoyed manipulating foldables. They remained committed to their tasks and employed their foldables which had been kept in special protective envelopes or glued in their notebooks.

## 4 Discussion

We may establish a bridge with the different approaches to learning such as the auditive/visual/kinaesthetic student in Neurolinguistic Programming (NLP) and the Multiple Intelligence (MI) of Howard Gardner. Both approaches present a way of gathering information which involves the body and the emotions through manipulations: in NLP, it is the kinaesthetic sensory modality and in MI it is the spatial intelligence. Foldables enable the learner to exploit these entrance points to meaningful learning. As the brain manipulates knowledge, the body, through foldables, manipulates it as well thus enabling the learner to represent this knowledge structure in a 3D fashion just as the brain organizes this information in a more three dimensional way among its neurons.

## 5 Conclusion

Both concept-maps and foldables organize data, establish links, and enable the brain to select pertinent information to be used to accomplish a task of the moment or at a later date According to Zike, foldables *'(...) provide a sense of student ownership (...)'* (Zike, 2001, p.2). We can say the same for concept-mapping. Combining both concept-maps and foldables such as presented on Ms Zike's web page (www.dinah.com/conceptmap.php) enriches and motivates learners to commit themselves 'physically' to their learning.

Research in this combination would be advisable to identify the range of improvements in learners regarding their performance at assessment and knowledge retention.

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