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TEXT CONCEPT MAPPING: THE CONTRIBUTION OF MAPPING CHARACTERISTICS TO LEARNING FROM TEXTS

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Abstract: Text Concept Mapping (TCM) is based on graphical differentiations representing the text's content and structure components, on explicit semantic relations between components, and on an hierarchical organization of the components representing levels of generality and importance. TCM combines graphical organizer ontology with the Language of Thinking (LOT) ontology, proposed by Tishman and Perkins (1997), providing a database of epistemic stance, intellectual processes and products concepts. Effects of using TCM were tested during one school year study (4 classes, 112 eighth graders): In the first semester, language arts teachers practiced materials, according to an assigned study condition: two classes were taught using concept mapping, one with practicing LOT (TCM class); two classes were taught through regular learning skills program, one also practiced LOT. In the second semester, subject-matter teachers directed a collaborative inquiry process of preparing inquiry projects. The classes were tested on language, mapping, comprehension, and writing skills, before and after the intervention, and at the end of the year. Inquiry projects were evaluated also at this time. Results indicate an advantage for some measures of LOT, mapping, comprehension, and writing in the TCM class, and also in some measures of the inquiry projects. We propose that TCM is a potent mediator for learning with texts and for conducting complex learning tasks, compared with concept mapping only.

1 Introduction

Graphic organizers (GO), such as concept maps are effective cognitive tools for externally representing learners' knowledge and their developing mental models that are constructed and updated during an interaction with a text (Kozminsky, 1992). GOs assist the learning process before, during or after texts are read, and can be constructed by students, by experts, or in collaboration. When they precede a text, they can be considered as spatial advanced organizers.

The visualization of mapping as an external representation, supplies cognitive support and reduces cognitive load from the learners' working memory (Sweller, 1994). The off-loading process enables the learners to invest more cognitive resources in the comprehension processes, thus leading to more meaningful learning (Novak, 2004). In this sense, concept mapping (CM) can be regarded as a mindtool (Jonnasen, 2000).

2 What is Text Concept Mapping?

Text Concept Mapping (TCM) is a process in which texts are translated into GOs according to the following layout: Graphical-geometric shapes are arranged in hierarchical order, with the content concepts represented in ellipses, and the rhetoric structure concepts in rectangles. Concepts are connected with directional links and connectives, describing the semantic-logical relations between them. The concepts are arranged in clusters, including a rhetoric structure concept with its content concepts. Concepts from different clusters can be connected by cross lines (Kozminsky & Nathan, 1996).

2.1 Description of TCM

A description of a map following TCM is presented in Figure 1 of the text: *Sex at adolescence in our permissive era* (Table 1).

Table 1: The text: *Sex at adolescence in our permissive era*

In our permissive era, sexual relationships seem to be simple matter, clear and known. Nevertheless, a simple glance will expose an absolute different picture. In many cases, home, family and educational institutions fail in sending clear messages. Missing clear criteria for "proper" sexual behavior, the young have difficulty in determining a sexual-moral value system. From this point, the way to an unrealistic attitude towards sex is very near. The young cannot set sexuality as part of their personality. Therefore, some feel used and depredate while having sex. It's possible to find some who pretend to be "open" and free, therefore they have casual sex in any chance. Finally, there are those who see sex as pure and sacred, that its realization is the highest manifestation of love. As a conclusion we can say, that the young will have disappointment and confusion in future. With addition of myth, prejudices and superstitions, they will be faced with difficulties and complications in sex life in worse cases, and reach pleasure and satisfaction in sex life, in better cases.

2.2 *Using TCM in learning environments*

In our educational and experimental work, students are engaged in TCM in several stages:
Stage 1: (1) Brainstorming the existing knowledge; (2) Constructing a semantic map; (3) Constructing a concept map (CM). **Stage 2**: Reading the text. **Stage 3**: (4) TCM; (5) Comparing the maps obtained from CM and TCM and constructing an integrated map.

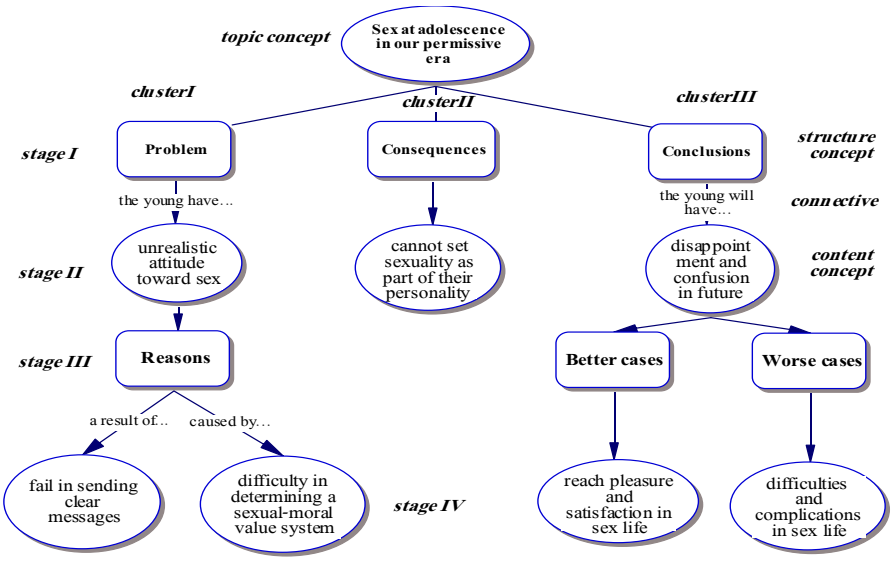

Figure 1: TCM the text: *Sex at adolescence in our permissive era*: A partial map with explanations of its components.

Stage 1: (1) Brainstorming (with the entire class or in groups) (Figure 2).

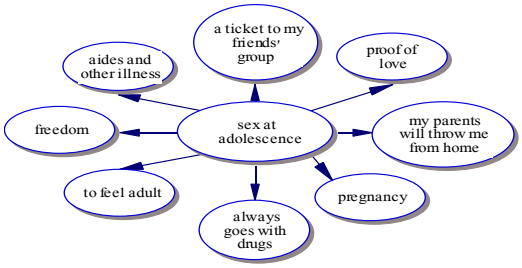

Figure 2: Brainstorming the main topic.

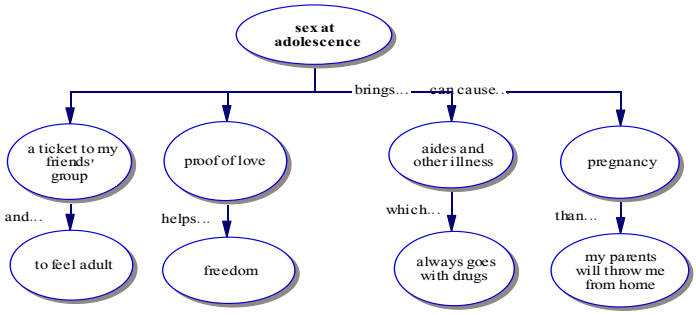

Figure 3: A Semantic map.

(1) An associations map is constructed (Figure 2) triggered by the text's main idea or topic as provided by the teacher, or by scanning the text's title or other organization markers. During this stage, there are no demands to organize the concepts in hierarchical order, to interconnect them and or to distinguish between content and organizing concepts.

(2) Transforming the association map into a semantic map (Figure 3): The students classify the concepts into groups on the basis of semantic similarity, e.g., "Aids and other illness" and "pregnancy". Then they are asked to label the groups.

(3) CM constructing (Figure 4): Since the students are familiar with the map's structure, they are required to sort the concepts in the appropriate rectangles and ellipses, and to find suitable connectives between the concepts (Figure 4). The following mapping activities promote knowledge activation and

organization: (a) grouping into clusters (reasons, consequences); (b) distinguishing between structure and content concepts, and representing them by appropriate graphical shapes; (c) locating concepts in an hierarchical order, and (d) labeling the directional links and connectives (e.g., cause…, to feel…). The concept map constructed in this stage, serves as an advance organizer that consists of the students' existing knowledge, thus assisting them in the reading assignment.

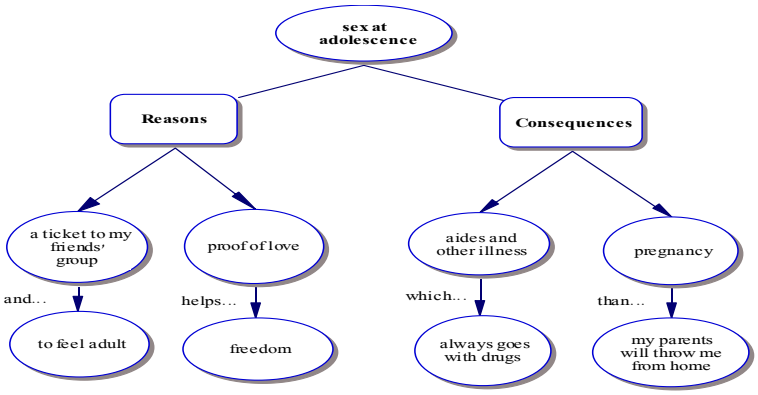

Figure 4: A Concept map.

Stage 2: Intensive study of the text: The students study the text with activated knowledge available either mentally or externally on the semantic map.
Stage 3: Text Concept Mapping (a map similar to the one in figure 1). In TCM, students engage in the following activities: (1) identifying and listing the text main ideas (2) grouping the concepts into clusters according their context; (3) exposing the text's rhetorical structure, and finding the suitable organizing concept for each cluster; (4) hierarchically arranging concepts in the clusters, according their importance and the text's developing content and arranging the clusters in the map; (5) drawing lines and arrows between the concepts within clusters, and cross lines between clusters; (6) labeling the connectives, and writing them on the lines; (7) reflecting on the mapping process by comparing the map to the text, omitting or adding content or structure concepts and relabeling or redefining connectives.

The students are allowed to perform TCM with some consideration of the CM previously constructed, by "borrowing" relevant concepts and clusters. When students become more skilled in the mapping process, they can TCM during the reading process, utilizing or directly building on the previously constructed semantic map. However, TCM using an existing map may fixate students' thinking and understanding if they refer only to the data appearing on the semantic map. This method, that requires mental separation between the "old" knowledge and the "new" text concepts, may tax students with learning difficulties, or less skilled mappers.

2.3 TCM characteristics: Combination of two ontologies – the graphical and the language ontology

The precise usage of concepts in TCM, some of which are anchored in the text (content concepts), and others (structure and connective concepts) are "imported" from the text or from the learner's own knowledge, has similar characteristics to another conceptual system: the Language of Thinking (LOT) system (Tishman & Perkins, 1997).

LOT includes terms that specifically describe mental states and processes, and is divided into terms that relate to three different functions: Epistemic stance (to assume, to suppose); intellectual processes (to analyze, to interpret); and intellectual products (conclusion, argument). Tishman and Perkins suggest accompanying the teaching processes with thinking organizers, such as concept maps, which can assist learners in assimilating LOT concepts.

The map construction may raise dilemmas regarding the studied materials, thus forcing the learner to be more active in the comprehension process. For example, the learner must check the correctness of the chosen concepts, decide on the specific spatial format, choose connective words for representing the semantic-logical relations between the concepts, etc. These thinking processes are the "essence" of the mapping, and support meaningful learning with text processes. Therefore, mapping a text using the language of thinking concepts in order to represent the text's main ideas and the relations between them, can serve as a useful mediator for meaningful learning with texts.

We propose that concept mapping (CM) and LOT activities are synergic, and combine complimentary ontologies into a new TCM ontology. The construction of this ontology is a result of conducting an epistemic game that is based on a set of performance rules and constraints, and on learning goals (Collins & Ferguson, 1993). On one hand, concept mapping employs the LOT ontology in order to select the appropriate concepts for representing the text's structure and content in a precise manner; on the other hand, LOT employs the map's graphical format in order to externalize the abstract relations existing between the text's concepts.

The reciprocal use of mapping and LOT in order to get the highest compatibility between them is appropriated with the learning goals, and is assisting in text meaningful learning, by adding a depth dimension for the mapping process, and by improving the language quality.

3 The study: The contribution of TCM to learning from texts

Effects of TCM on learning abilities were tested by assessing language, mapping, comprehension, and writing skills, before and after an intervention, and at the end of a school year, following inquiry learning (Nathan, 2004). 112 eighth graders from four classes participated in the study. The classes were assigned to a two by two (CM with or without LOT) instructional design. During the first semester the classes received organized learning skills instruction according to their assigned condition, and in the second semester they conducted collaborative research projects.

3.1 Results

Results indicate an advantage for the TCM class, compared with the other classes, in the measures of concept mapping, language of thinking, comprehension, and essay writing, both after the direct intervention phase at the end of the first semester, and at end of the year. We computed effect sizes of each experimental group relative to the control class. In most of the intervention measures, the highest effect sizes were found in TCM class compared with the mapping or the language classes. This result demonstrates a unique advantage of the combined intervention over the separate interventions.

4 Discussion

The contribution of this study is by proposing to combine the graphic and language elements in TCM. The epistemic TCM game consists of applying graphical presentation and organization rules together with language concepts supplied by LOT-the language of thinking system that describes processes, products and attitudes of thinking, in the course of learning from texts. Together, they explain the advantage of TCM. Therefore, we recommend TCM as a mediator for organizing information during learning from texts and as a template for preparing inquiry projects.

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