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New perspectives about teacher training: conceptual maps used for interactive learning

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Abstract

The purpose of this article is to present the new perspectives about teacher training namely using conceptual maps for interactive learning. We describe the conceptual map and its phases of development individually and in groups, and its use in teaching and assessing knowledge in Teacher Training programs. We present examples of conceptual maps used in the activities with the students, emphasizing the importance and effectiveness of their use based on feedbacks of the students who were involved in their implementation. Article brings new contributions in the field of teacher training, for example, interactive-creative learning concept, an original classification of strategies for teaching-learning-evaluation, conceptual maps used in the didactic field.

Keywords: conceptual map; constructivist learning; interactive - creative learning; teaching; social interaction.

1. Paper Rationale

The essence of knowledge lies in how knowledge is structured. In other words, in the process of knowledge, the relationships that are established between the ideas are important. Performance depends on how individuals organize their experiences, ideas, how they integrate in cognitive structures and their applicability. A potential tool to capture important aspects of these interrelations are the conceptual maps. Used in education, policy studies and the philosophy of science, conceptual map/cognitive map/argument form provides information and visual representations of knowledge about structures and modes of argumentation.

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Giving a prior importance for making connections between concepts, the conceptual maps come to dethrone education based solely on memory and simple reproduction of definitions or algorithms to solve problems, promoting the reason that the students must be aware of how to link the concepts between them. Creating of conceptual maps open new perspectives to a learning process more active and conscious.

Constructivist learning theory argues that new knowledge must be integrated into the existing structure of knowledge. The conceptual maps favor this process by stimulating the learner to pay attention to relationships between concepts.

Used in business planning, the conceptual maps conceptualization helps to fulfill the goals and objectives, material and human needs, resources and capabilities needed and other variables involved in the proper conduct of business. Used in the evaluation, the conceptual maps can facilitate the improvement, recovery or acceleration programmes or can be used as an evaluation tests.

Teachers using conceptual maps to organize and to plan the process of instruction, while are familiarizing the students with this technique, promotes active and conscious learning, because, both partners (teacher and students) can better understand the conceptual organization of a domain and their own knowledge.

The creation of conceptual maps in a interactively way, in the group, has the following advantages: stimulate the generation of ideas, like brainstorming, focus on the task group, encourages cohesive group organization and team spirit, the results appear relatively quickly, visual graphic representation of the product provides simultaneous information about the major ideas and interrelationships between them, ensures accessibility for all participants involved.

2. Paper theoretical foundation and related literature

Social interaction (interactivity) favors the emergence of social cognitive conflict, stimulating learning, change personal representations and favors two learning principles:

1) The first principle is derived from Piaget's constructivism: by means of the objects change assimilation schemes - accommodation - balancing (cognitive conflict);

2) The second principle is derived from the social psychology of development: confrontation of viewpoints may perform transformations of socio-cognitive representations of the conflict and cognitive restructuring; (see Francois Raynal, Alain Rieunier, 1997, p. 159)

Building a correlation between psychosocial links of group and group cognitive structure creates resources for all students' learning progress.

Researchers as Vîgotski in Russia, Bruner in USA, Wallon in France focus on social interaction and socialization, as important factors in development and learning. The first author explains about learning in relation with an adult and about the "zone of proximal development", the second discusses about the interaction as tutoring.

Since interpersonal interaction is based on mutual influence, trade verbal or nonverbal cognitive, affective-emotional and social aspects, it has a *„therapeutic value"* (Oprea C.L., 2013, p. 570-574) for group members as they occur approval processes, transfer, adapt, balancing formation of attitudes and beliefs, (self) assessment of cognitive schemas and personality traits.

The professor as a mediator is a facilitator of the complex learning relations and communication, of inter-learning, self-help, support and advice, guidance and cooperation. "One of the qualities of a good mediator is to be careful with the learner." (Francois Raynal, Alain Rieunier, 1997, p. 222) and „the enthusiasm of the teacher is the key for a good learning in school." (Oprea C.L., 2013, p. 602)

Many studies have shown that organizing knowledge in concept maps helps teachers and students to develop such a meaningful learning. (Chevron, M.-P., 2014, p.1)

Described for the first time in 1977 by educational psychologist Joseph Novak, conceptual maps is presented as a visual representation of the structure of technical information that describes how a domain concepts interrelated. The development of these practices are based on Ausubel's theory that learning new concepts thoroughly depends on existing concepts in the mind of the student and the relationships established between them. Specifically, the new learning becomes meaningful when is basic ideas on which to build new reservoirs in the mind of the learner. Conceptual maps give a great importance for making connections between concepts in the learning process.

In education, Novak has developed a theory of conceptual map with wide applicability in assessing learning

within the school system.

"Conceptual maps reflect cognitive and emotional networks formed during life on certain concepts." (Horst Siebert, 2001, p. 92) They, and especially their changes, reflect the emergence of knowledge. So, they are renewing the cognitive networks by included new ideas in the cognitive structure which are rearranged by acquired knowledge. New ideas bear fruit in the land of the existing cognitive models.

Novak and Gowin (1984) describe the logic of conceptual map by defining three key terms: concept, assertion, learning. Statements linking concepts; they must be concise and complete at the same time accessible; the learning involves the active construction of new conduct allegations. „This method improves the quality of teaching and learning" as shown by Garabet M. and Miron M. (2010)

In 2000 T. Stoddart and others have developed a method for assessing the learning achieved by students using conceptual maps, giving optimal results. In this connection, I.M. Kinchin (2000) reveals the advantage of conceptual map to open a window into the mind of the student.

Ruiz-Primo Shavelson (1996) characterized the concept of the map taking into account the assessment of:
- Task that invites the student to provide links between cognitive structures we have in a field;
- As the answer given by the student;
- Scale of the conceptual map can make the evaluation with accuracy and consistency.

Many studies demonstrate „that learning is most effective when students are involved in this process. Training strategies that engage the students in learning stimulate the critical thinking increase the level of awareness and responsibility an their part". (Oprea. C.L., 2014, p. 494)

„The concept map lets students represent their understanding of domain knowledge in a well-organized format". (Mih C., Mih V., 2011, p.1). „As a kind of mental models they have great potential in knowledge assessment due to several significant advantages" – as said Anohina-Naumeca A., 2012, p.2

3. Author's contribution on the existing theory and practice in educational field

Conceptual maps or cognitive maps can be defined as a mirror of thinking, feeling and understanding of the person/people who develop them. They are an diagrammatically expression, representing as an important tool for teaching, learning, research and evaluation at all levels and in all disciplines.

The way to make a conceptual map can be a strictly directed way by teacher or by student's choice. Thus the teacher may require that concepts can be used, which are references (links) or how they relate to each other. The task can be one in which student is completing the elliptical space in a structure map (either nodes or references). In the opposite perspective, the student may be allowed to choose the concepts and to establish relationship between them. Cognitive demands and progress are higher in this manner (free elections) than if it has a strict control of elaboration the conceptual map.

A new concept which we propose it is „*the interactive-creative learning"* (Oprea C.L., 2014) that takes place in relation to others and learning material and is based on the construction and deconstruction processes of creativeness and innovativeness. It occurs as a result of individual and collective efforts by the interaction between students and/or between students and teacher, on the one hand, and between student and the content taught, on the other hand. *Interactive-creative learning* aims social exchanges at acquiring new knowledge, stimulating construction and redefining meanings, receptivity to new experiences, sought and resolved through exploration, deduction, analysis, synthesis, generalization, abstraction, materialization, focusing on the connections between concepts and requiring a deep intellectual engagement, psychomotor, affective and volitional.

Interactivity is based on mutual relations and refers to active learning, in which, the learner acts on the information to turn it into a new, personal and internalized. In respect of the constructivist learner, he re-builds the way by exploring the environment/education, solving problems and/or using the information gained in new situations.

From this point of view, the principles which is based the interactive strategies are:
I. Students construct their own meanings and interpretations of the learning content;
II. Learning goals are discussed, negotiated, not imposed;
III. They are promoted the methodological alternatives for teaching - learning - assessment;
IV. The learning tasks require transdisciplinary and multidimensional analysis information of reality;

V. The evaluation is more reflective by integrating complementary methods evaluation;

VI. They promote discovery learning and creative problem solving.

The interactive-creative learning is a process of creating meaning of the new information and prior knowledge, by transformation of the cognitive structures of the learner as a result of the incorporation of new acquisitions (knowledge, skills and abilities) by hiring intellectual efforts and knowledge.

Interactivity occurs directly (student-student/teacher and learner-content) and indirect, virtually, remotely via the Internet (as in fig. no. 1).
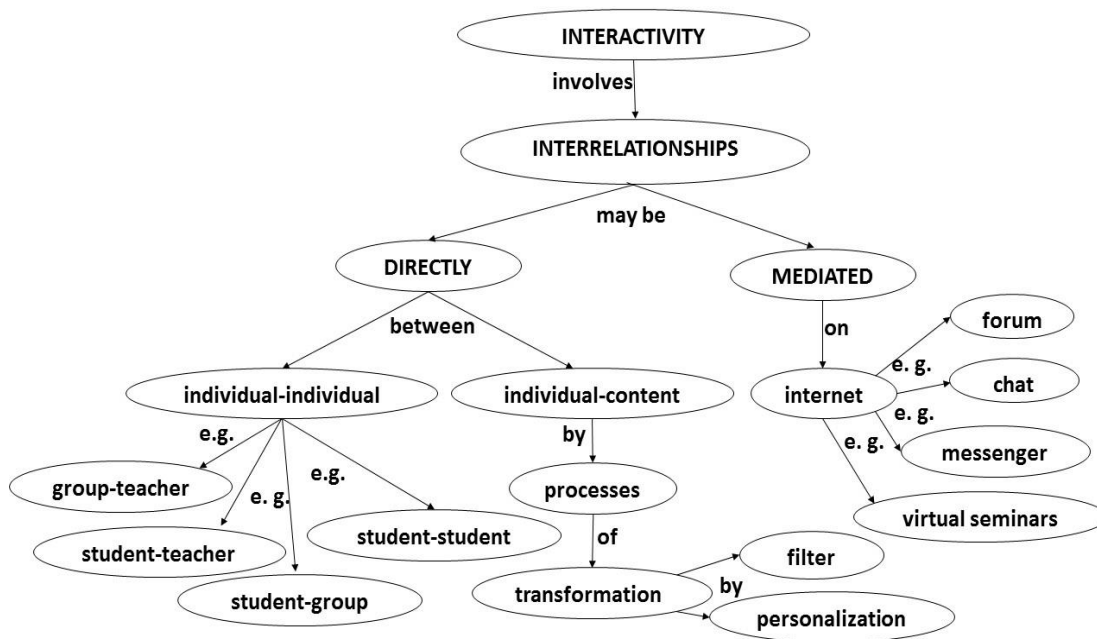

Fig. no. 1: Conceptual Map of interactivity

Although it was recognized as a potential method of assessing the student's cognitive structure, conceptual maps are often used as training tools.

If concept maps are used as instruments to measure students' knowledge structure and organization of its, it takes time and effort to highlight the impact of different application techniques (strictly guided or unguided) on the connections they have children.

4. Author's contribution on the topic

We propose a conceptual map of what is a conceptual map: a graph consisting of nodes and links by arrows. (see fig. no. 2) The nodes correspond to important terms (written concepts) in a domain. References expressing the relationship between two concepts (nodes). The indication from the line arrow shows how the two concepts are related.

Conceptual map can be defined as that chart that includes concepts (plants - located in the center of the map or secondary - located by the edge of the map) rankings to determine where their established, connections between concepts (which communicate the way it is understood the relationship between concepts) and interpretations that reveal relationships between different parts of the map. The combination between two conceptual nodes, including the words from the arrow, is a logical statement, the core of the conceptual map and the smallest unit used to judge the validity of the relationship expressed between the two concepts. Such conceptual maps reflect important aspects of the conceptual system that the students have it in a certain domain.
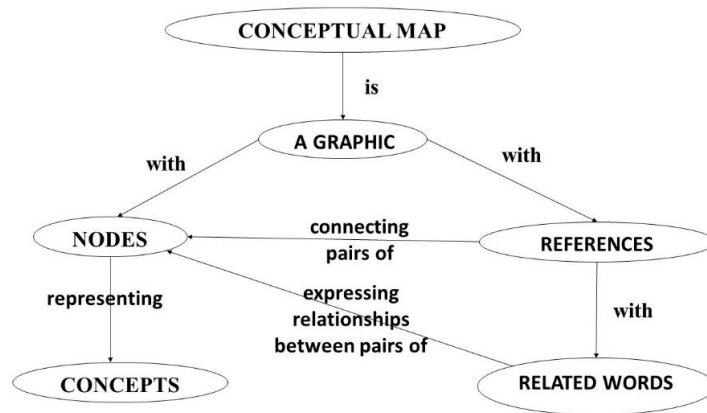
Fig. no. 2: A conceptual map of what constitutes a conceptual map

Steps for building a conceptual map:

To build a conceptual map first we have to provide a list with 10-15 key concepts and ideas about what we concern and some examples. Starting from a single list we can make several different conceptual maps, based on the arrangement chosen to represent a conceptual map

We propose 7 steps in the creation of cognitive maps:

Step 1: We write each concept/idea and each example on a little piece of sheet of paper (you can use different color paper for concepts and for examples)

Step 2: We arrange the first concepts on a large sheet (poster) as follows: general concepts (abstract) in the top sheet and the other below. We did not include the examples yet.

Step 3: If it is possible, we arrange themselves so as to derive concepts from one to another. At one point we can add more concepts to facilitate understanding and explain existing ones and develop them.

Step 4: We draw lines from the concepts above to the concepts that are related and between the concepts which are at the same levels. The arrangement may be changed continuously.

Step 5: The next step is the most important and perhaps the most difficult: on the interconnecting lines we spell a word or more to explain the relationship between related concepts. It may further rearrange the pieces of paper such that the relations between the concepts/ideas can be easily viewed.

Step 6: We write the examples near the concepts of belonging and connect them through a word like: example.

Step 7: We copy the result, achieving the conceptual map, on a poster.

We can choose a different geometrical shape to represent the concepts and the examples, like circle or square.

Creating a conceptual map requires sustained mental effort for making connections between concepts.

The development of conceptual maps in group comprises six stages:

Step 1: PREPARATION: - Selection of partners; - Setting the subject (through brainstorming);

Step 2: GENERATE IDEAS, STATEMENTS: - Defining concepts and the rationale of their use;

Step 3: SET STATEMENTS:- Selection of ideas; - Making their ranking;

Step 4: GRAPHICAL REPRESENTATION: - Developing conceptual map (respecting the same steps as for individual development);

Step 5: INTERPRETATION, EVALUATION of the CONCEPTUAL COLLECTIVE:- Check the list of concepts; - Analyze the relevance of concepts to the initial goals; - Analysis of the links and connecting concepts statements;

Step 6: USING PAPER CONCEPTUAL:- For planning, design work, development and evaluation projects;

Horst Siebert, analyzing the mind maps as a tool for establishing the mental order, made specifications of their importance for understanding the links between concepts, saying that they are "a copy of our mental networks, our neural connections. (...) A cognitive map contains both abstract knowledge and empirical evidence, and also logical disorders, such as enthusiasm or rejection. Can be filled "branches" so ordered abstract concepts and spontaneous associative chains. Themed chains are formed. "(2001, p. 170)

Concept maps can be prepared at the beginning of a teaching approach in order to assess the initial cognitive and emotional state of pupils. They can be analyzed and compared to each other and can be a starting point for the next educational activities.

In a later stage, after the students are going through the training programme they can restore the conceptual map and it can be compared with the initial. We can thus analyze the weaknesses of the map, if are the concepts missing and the knowledge networks (rather oriented towards empirical reality or reality shows theoretical abstract).

The assessment of a conceptual maps (by comparing the original one with the final one) will highlight the progress of learning and the complexity of cognitive structures; it can be seen that during the course, the constructs were completed or became more varied.

A conceptual map made with students from the teacher training programme, around the concept of interactive didactical strategy is shown in fig no. 3.

Fig. no 3: The conceptual map of the interactive didactical strategy

Our proposal refers to the elements that determine the choice for a particular teaching strategy in general and interactive in especially. These are following:
- the leadership style of the instructional activity - education;
- how learning will occur (through cooperation, through competition, through collaboration, research, discovery, through questioning, through experimentation, the practical applications through active reception etc.);
- the ways and means that will lead to desired learning challenge: methods, procedures, techniques, means of education (teaching materials, equipment, new technology, etc.);
- the forms of organization of work (front, collective groups in micro group, individual, mixed);
- how the pupils participated in the activity;
- the time required to implement the strategy chosen;
- the type of targeted development (cognitive, emotional, social, practical approach);
- the presentation of content (from highly structured to the less structured, from the algorithmic heuristics, including intermediate levels);
- the context in which the learning experience (in the classroom, outside the classroom, laboratory etc.)
Our opinion regarding the classification of teaching strategies is:
I. After purchasing type and desired results to be achieved, we make the following classification:

I.1. Strategies for acquiring new information/knowledge (mostly informative);

I.2. Strategies for practice/application of new information and practical skills development (mostly applied);

I.3. Strategies for evaluation of new procurement and practical information (skills and abilities, skills) and self-evaluative capacity development (predominantly evaluative);

We chose to use the term "mostly" because within each strategy it is a focus on something specific (theoretical knowledge, the practical application skills, the ability to (self) evaluation). However, distinctions are made for theoretical reasons, because there may be no concrete boundaries between information acquisition, cognitive and practical skills. (see Fig. no. 4.)
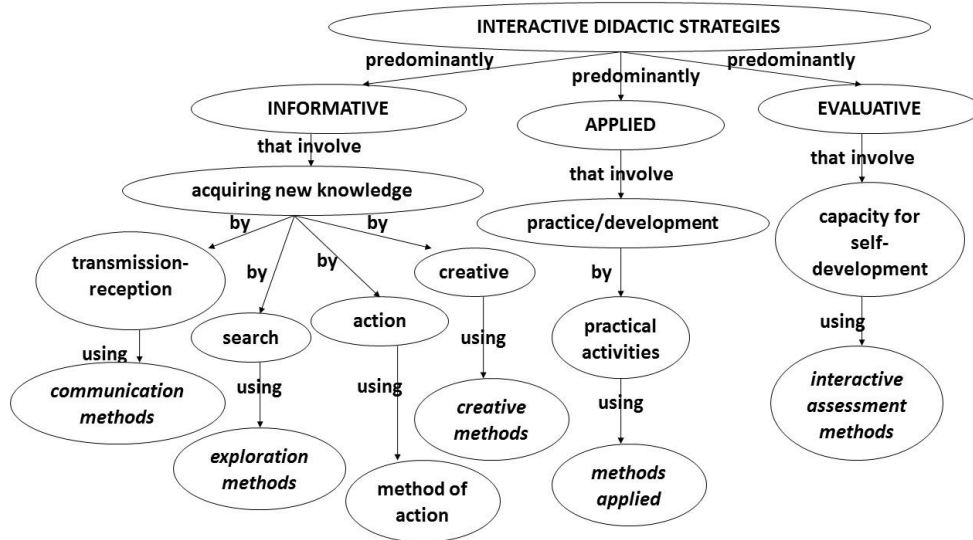

Fig. no. 4: Conceptual map representing classification interactive didactic strategies by type of acquisition and expected results

These didactic strategies can be interactive as far as they are based on mutual interrelation, as follows:

I.1. Interactive strategies for acquire new knowledge involve: teaching/peer learning, student involvement in group activities, teacher participation in the activity as a mediator of the potential socio-cognitive and constructive conflict or co-participant with students in the knowledge construction.

I.2. Interactive strategies for practice and apply the new information relates to: the organization of practical activities that build on working together in cooperation or competition for training and skills development, abilities to apply in practice what has been learned. Practice methods are interactive and presume practical action (action research projects, investigations, exercise, case study, conceptual maps and so on.)

I.3. Interactive strategies for evaluation consist in involving student in its evaluation process, stimulating personal reflection on their own learning activities, acknowledging errors and how coverage gaps. They are based on self-evaluative capacity and boost confidence in its own strength. Interactive strategies are aimed primarily for correction the process, for improve the results and performances and for stimulate further learning, not for punishment. Even when that a student done something wrong, he can learn from that. Interactive and alternative assessment methods are: portfolio, reflective journal, conceptual maps, 3/2/1 method, project, case study and so on.

Conclusions

Advantages of using conceptual maps:

-    Using conceptual maps in learning determined the easiest way of representation of the learning process and evaluation of the knowledge and skills of students;

- Conceptual maps were used to organize existing knowledge in the minds of students and to prepare new assimilation, to organize planning and design of activities, to research carried out in groups or individually;
- 92% of students who participated in the construction of conceptual maps mentioned as a feedback that they have mastered new concepts more easily, they integrated them in the existing knowledge system and conducted a thorough learning;
- Presenting like a knowledge network they facilitate easy understanding, knowledge and application of theoretical knowledge in practice because concepts are not alone, but in relation each other. The ideas can neither be taught nor evaluated without put them into a link;
- They facilitate to visualize the relationships in knowledge and the schematization is done for the benefit of synthesis and for avoiding to use long explanatory phrases;
- Performance evaluation is facilitated by this technique because it shows how participants think about and how they use what they have learned;

Disadvantages of conceptual map can be the time required, the high level of standardization, rigor and order in which the individual must work for it

For assessing a conceptual map we can be drawn several criteria:
- Some based on quality claims (meaning all correct information)
- Other statements calculating percentage of a correct student data in relation to all their possible;
- Ratio of right - wrong.

Conceptual Maps application: they can be used to stimulate the generation of ideas like brainstorming; to design a complex structure (ie belonging to a long text or a web site); to communicate or present complex ideas; to explain how new knowledge fits into the old system in a field of study; to create alternative solutions to a given problem; to explain knowledge management; to analyze and evaluate the results; to make more easy the understanding and accessible the knowledge; to illustrate the perceptions, representations and thoughts about the reality, facts and things; to represent networks between concepts and diagnose gaps and lack of linkages between them; to stimulate group activities.

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