PRODUCE KNOWLEDGE WITH A COOPERATIVE REWORK OF CONCEPT MAPS

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Abstract. The traditional teachings are used very often in a repetitive learning, namely, the transmissibility of knowledge through simple acquisition and following memorization of the information. This kind of didactics pushes to the passivity toward the study: the students, in fact, even if understand what the teacher illustrate, they don't take possession indeed because they don't integrate the new knowledge with the old one, and so they don't realize a significant learning (as sustained by Ausubel). Inside this objective, Concept maps are a simple and effective didactic tool, and allow the students to discover, to select, to connect, and to generalize new knowledge. As the use of the maps allows to learn how to learn, to create and to use the new knowledge in the most useful and convenient way, it is desirable to continue such kind of experience.

1 Laboratory methodology with the use of the maps

The traditional teaching, is often a repetitive learning, indeed transfer knowledge through a pure and simple acquisition and subsequent retention of the information. This type of didactics pushes to the passivity toward the study: the students, in fact, even if understanding what the teacher illustrates, they don't take possession until they don't integrate the new knowledge with those that they already possess, realizing so a meaningful learning (as sustained by Ausubel, 1968). The laboratory and cooperative didactic aim, as already illustrated in other occasion (De Petrocellis & Genito 2010), it is instead that to favour a type of meaningful, active and creative learning, that allows the people to be and to feel active subject of the relationship teaching-learning. In order to achieve this goal, the use of a simple and effective didactic tool as the concept maps, allows the students to discover, to select, to connect, and to generalize a new knowledge.

2 Didactic experience

2.1 Characteristics of the classes and finality

The illustrated experience refers to the use of Concept Maps in a class of a III year of course in an Industrial Technical Institute in Napoli (Italy), in the *Elettrotecnica*, basic discipline helpful to understand the vocational subjects:
- Class A, evening classes for workers students, with 23 people, is differentiated by age (the youngest are 19 years old and the oldest 58 y.o.) and by gender (3 women and 16 men). There are also a graduate person and a girl coming from Belarus.
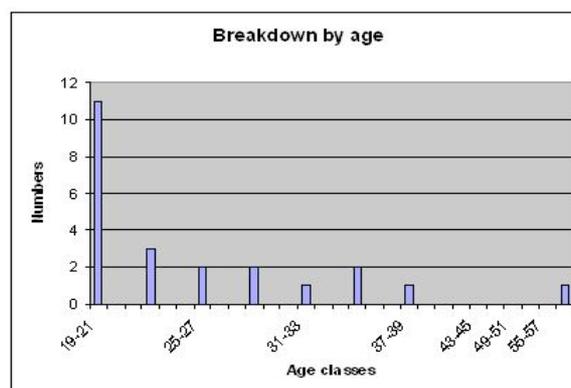

Figure 1. Breakdown by age of the class.

Many students were school dropouts. For the presence of all these diversities between students, it was choose to make a new and exciting didactic experience. The class had no experience on concept maps.

The key objective of the experience is forming a class group tending to curb school dropouts, requesting the reasons, in order to let them become accustomed to a conscious and active participation, enhancing the operational capabilities of all, especially youngsters with major learning difficulties. The chosen methodology was *plural*, because everyone can contribute to achieving the objectives. This methodology would favour:
- Subdivision of groups according to related "intelligences" in order to enhance teamwork;
- The use of ICTs, as surely closer to young people' experiences;
- A challenging environment and friendly work;

- Use of concept maps and didactic collaboration, so that everyone could express their personalities and their ideas, feeling accepted and being able to count on the help and respect by everyone, teachers and classmates.

2.2 Methodology

The use of concept maps answers to many important principles of a meaningful learning:
- it allows the welding among new and old knowledge;
- it favours meta cognitive learning;
- it favours the hierarchization of the concepts;
- it encourages the discovery of links among different concepts.

This is an example of a didactic trail that is result of a formative path that put the students as protagonist, in order to stimulate the growth of their self-esteem, autonomy and identity. Not always, in the daily didactics, we succeed in applying such methodology in a complete and exhaustive way.

2.2.1 Teacher explains the topic and group discussion

Class A topic was the existence of electrostatic and electromagnetic fields. The didactic process begins with a brainstorming, led by the teacher, for conceptual knots identification. Everything is shown on a map drawn up (with a PC) and projected on a screen visible to all (at this stage, the teacher helps students express themselves, in order to encourage their participation in the process). Thus, taking account of prior knowledge of students, the teacher assumes the task of helping students to express their pre-knowledge and to produce, using a PC, the *collective knowledge map*, a map which is projected on a screen, so that it is visible to all. All students contribute to this construction, which encourages their participation in the ongoing process.

2.2.2 Individual study with editing of personal map

The activity went on with an individual study in which students have examined the subject also with appropriate research. The research conducted on the Internet and on other sources allows the students to broaden their knowledge horizon, even if it may lead, sometimes, to a kind of disorientation for the multiplicity of sources, for the profusion of information, and especially for materials reorganization. After having made an initial map, it was necessary to revise and to correct it by reducing it or enlarging it with teacher's help. Concept maps have the function to connect and to organize the new and old knowledge, to schematize, to plan, to synthesize and besides they stimulate the creativeness, they favour the meta cognitive learning and develop the visual memory.
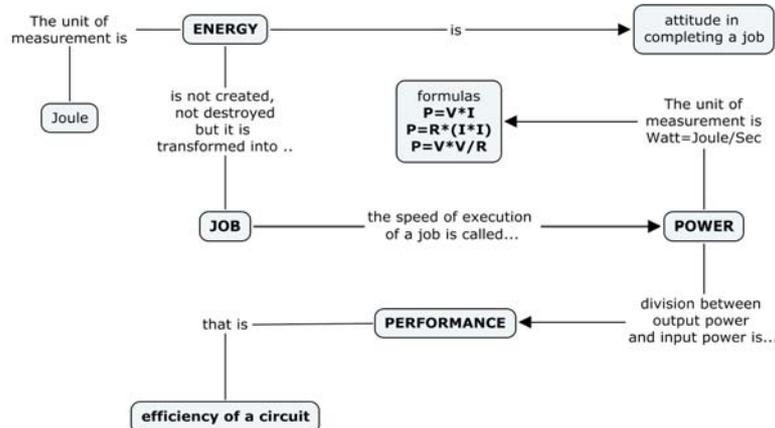

Figure 2. Personal map about Energy, Power, Electric Performance. (Student n 1).

Concept maps favour in the students the synthesis, correctness, wealth of information. We used the *CmapTools* software, which, thanks to its multimedia offerings, allows to make revisions and corrections also after some time, working not only with images, symbols, forms and texts, but also possibly with sounds, movies, hypertext, making it more immediate processes of learning contents.

Teacher' work was reduced to a minimum, encouraging self-correction, and limiting it to list to the student concepts and useful connections, that weren't on the map at the beginning. The individual maps are of course different from each other, representing the personal construction of knowledge, different for each student.

2.2.3 Reprocessing in small collaborative groups

The most interesting step was naturally concerned with the following revision of the maps in small cooperative groups. Cooperative learning groups are formed preferably homogeneously, with students of the same style of

learning and communication, according to the theory of multiple intelligences of H. Gardner, in order to promote the expression of the individual within the group. The theory of the multiple intelligences supports that the human beings are not provided of a specific general degree of intelligence, but that exist different relatively independent types of intelligence between them, logical-mathematical, kinesthetic, linguistic, spatial, musical, interpersonal, intrapersonal, naturalistic, existential, present in all the human beings and that the difference between the relevant intellectual features and services has to be researched only in the respective combinations.
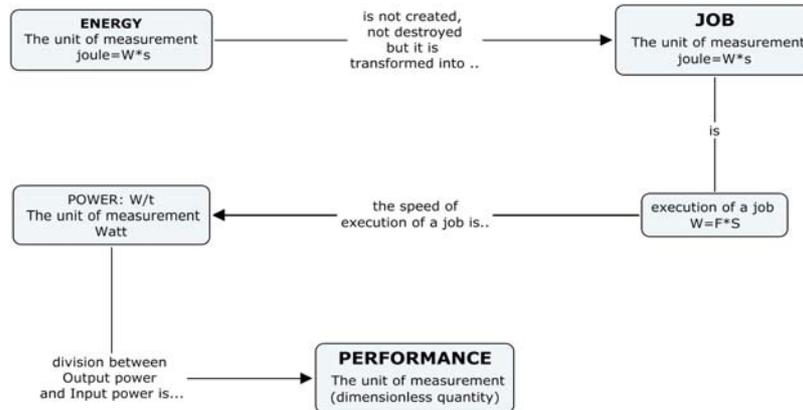

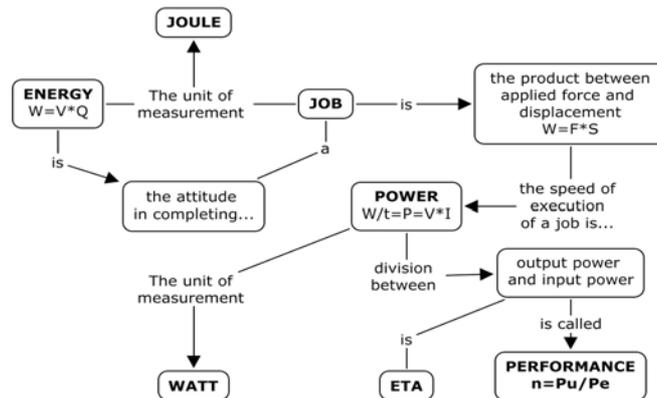**Figure 3**. Personal map about Energy, Power, Electric Performance. (Student n 2).

Figure 4. Personal map about Energy, Power, Electric Performance. (Student n 3)

The phases of the work were:
1. Individualization of the starting concepts
2. Collection of concepts to be included in the map
3. Selection of concepts
4. Construction of the map and links
5. Choice of words-bond (linking words)
6. Hierarchization of the map
It follows the collective map compiled by the group constituted by the students n1, n2, n3.

In this experience, it is passed from individual maps to collective map through a collective discussion of small group in front of one computer on which the software Cmap tools is installed. Cooperative work in small groups, in addition to the simultaneous enhancement of the collaborative behaviour and of the individual responsibility, promotes the acquisition of complex cognitive skills, such as reading comprehension or the solution of problematic situations that, if their structure is not well defined, are difficult to teach. In this context, the students, through mutual aid and "cognitive help", have those models, supports, feedback, which are more effective than the explanation of the teacher, for the evaluation and elaboration of their own personal knowledge, to enhance skills and competencies and to develop autonomy and identity. The collective construction of the maps has also developed a socializing function and of cooperative building of knowledge, facilitating the comparison on the same concepts and the validity of their reports. The collective editing of the maps has protected the element of negotiating concepts, important from the constructivist point of view.

The collaborative learning has encouraged the participation of individuals with their different attitudes, has promoted the exchange and made a creative space where we can experiment new concepts related to the

network among themselves. In the single groups, more people have been able to easily collaborate to the construction of the map making themselves aware that a conceptual map will never end!
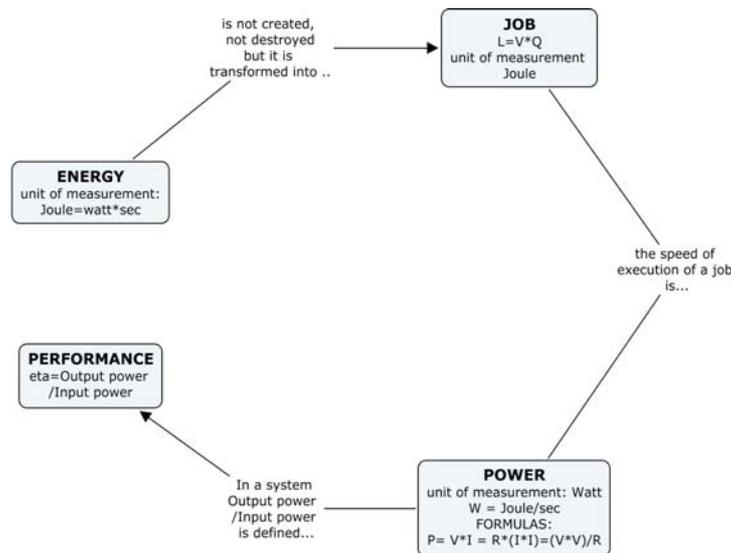

Figure 5. Group map about Energy, Power, Electric Performance (Made by Students n1, n2, n3, in group).
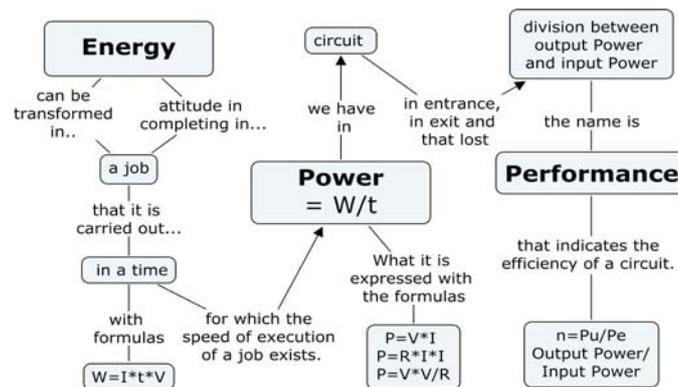

Figure 6. Map about Energy, Power, Electric Performance (Made by group 2).

3 Considerations of involved student

There are few educational experiences conducted with the use of maps, so the difficulty in setting the maps emerged in all its details, although going on with this activity, the difficulty was reduced. Through an anonymous evaluation by students, with a score from 0 to 10, these didactic experience showed that the concept maps favour the significant learning (7,2/10), allow to integrate new knowledge (5,7/10), have an important socializing function and knowledge cooperative construction (7,4/10), allow to visualize the nature of the concepts (7,8/10), to facilitate the memorization (8,1/10), to develop the abilities of the critical thought (6,6/10), to stimulate the visual perception (7,4/10), to develop the creativity (7,3/10), the reflection ability (7,6/10).

4 Conclusions

Since the use of the maps allows learning to learn, and to create and to use the new knowledge in a more profitable and effective way, we established to continue such type of experience.

5 References

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