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AN APPLICATION OF THE *HISTORICAL MODEL* IN *CMAP*

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Abstract. We propose to develop an understanding of the basic principles that give sustenance and consistency to the comprehension of a historic structure, under axles of thematic structure. In this case, the thematic structure is based in a disciplinary approach, in which some of the basic scientific disciplines [astronomy, physics, chemistry, geology, biology and social sciences (anthropology, history, sociology, psychology, economics)] are displayed, situated and defined. This is formulated in our digital interactive program called: *Kronos*, which was developed in two platforms: *CmapTools* and a *Web Based-Platform (HTML).* The main idea is to use, as the thematic structure, the basic notions that constitute the scientific disciplines, through a historical projection. The program, *Kronos*, recognizes four major constituent and consecutive historical periods: 1) Astronomical times: origins of the universe and formation of the solar system. 2) Geological times: evolution of earth and life. 3) Human times: origins and evolution of mankind (social times). 4) Present times: our current situation (today, here, you, me, us). The program *Kronos* is a system of multiple representations, interactive, articulated with hyperlinks to cyberspace sites. Through a visual representation (A), which creates links to a concept representation (B), a visual – concept card (AB) is created, which in turn contains channels leading to cyberspace through hyperlinks. Then students have to create their own representations, both visual and conceptual, by building a concept map.

1 Problem

Basic education, which corresponds to compulsory education, includes in Mexico the first nine years of schooling (Primary - 6 years and secondary - 3 years), and assumes a set of knowledge that everyone in society should learn. The biggest problem, we could say, is that this knowledge is excessive, broad, extremely ambitious, unstructured, isolated, without an integral vision, generating and promoting rote learning based on memorization without understanding. This knowledge is very narrow in meanings, with reduced cognitive operability and of little or no significance for the student. This reduces the possibility that students develop their own and creative thinking.

We believe that when designing a curriculum for basic education it is necessary to take into account structural and fundamental principles, since otherwise it is impossible for a student to learn the huge amount of knowledge that is being taught. The dominant pretension, assumes exhaustive learning of contents of knowledge of a wide thematic dispersion, only promotes rote learning instead of meaningful learning. Knowledge itself constitutes a huge universe of information that is increasing day by day, constantly expanding at an extremely fast rhythm, which is a characteristic of the contemporary world. We wonder: What should we teach? Which is the basic knowledge? Can we define the core competences for contemporary life?

2 Theoretical approach

We have a psycho-educative perspective in which it is assumed that the cognitive process of appropriation of knowledge requires that the student constructs and develops his own schemes of assimilation of knowledge as pointed by Piaget. The human capacities for assimilating knowledge are restricted to a gradual process in which the structures that allow comprehension develop. Learning requires to be conceived as a slow process of assimilation, under constant iteration of knowledge structures that are operative and allow constructing the meaning of new knowledge, as assumed Bruner, in a progressive spiral.

Active and meaningful learning happens when the learner selects the relevant information and organizes it through a representation that is congruent with the schemes of previous knowledge, under a set of principles that allows him to combine and to articulate in systems of multiple representations, such as: images, graphics, illustrations, animations, written texts, narrations, sounds, music, etc. The cognitive theory of multimedia learning of Mayer (2001) proposes different ways for processing information, that can be visual (iconic) or verbal (conceptual).

Coll, Engel & Bustos (In press) consider that representation systems constitute an operative part of cognitive processes when forming structural functional relationships. These symbolic systems become observable in the form of concept maps, diagrams, pictures, writings, musical notation, and so on. Representations are instruments of the cognitive apparatus that are mediators of both thought and communication. Zhang & Norman (1994) argue that the use of different formats for representing the same information can promote various cognitive processes, which can hinder or facilitate understanding.

On the other hand, Olson (1998) maintains that the impact that representations can exert on knowledge structures and ways of thinking is remarkable, because knowledge constitute intellectual instruments that facilitate thinking, as well as retaining or memorizing in an active way what is being learned. Kullberg (1996) has pointed out that the use of images in chronological sequences, in which the students can interact by selecting precise images within an interactive environment to obtain information, allows illustrating historical information from a multitude of points of view, in both general and specific levels. Our experiences indicate that the use of images and verbal representations in the teaching of history has a great power of evocation, which allows performing a substantive function in the teaching-learning process (Tirado, Fuentes & Gómez; 1996).

3 Proposal

We propose to adopt a series of principles that promote the development of basic structural knowledge. Basic because is the foundation for the comprehension and learning of new knowledge. Structural as it allows a concept organization that generates a global network of knowledge. We assume historical model organized since the origin of the universe to the present day and vice versa, from the present to the origin of the universe. This is prioritizing the knowledge that allows understanding the nature and origins of the student (Tirado, 1983). The idea is to identify principles from breaking points in history, from the fundamental events that transform history, which classify historical periods. Thus the student requires to identifying events, recognizing the most relevant of them and placing them in time, forming through this process his own representations.

In past experiences we have applied the *historical model* of our proposal in digital media by using playful means and complementing them with museum visits (Tirado & Bustos, 1998). However, in these experiences we appreciated one significat limitation, although the students played an active role, it was not a creative one. They did interpret representations, but they did not build their own ones. Therefore, the proposal of this new model has a more constructivist approach, as it demands the students to build their own concepts and representations in a digital media, by means of images and written texts.

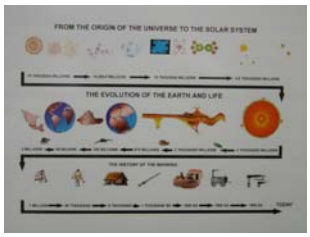
One principle that is universal and that enables to organize all the events that have occurred and will occur is the order of happening. This is the main principle that we use in our program called Kronos, in which events or phenomena are ordered in historical sequence, as they emerged; from the beginning of the universe to the present time, constituting thus a reference structure for placing events. History can be conceived as a comprehensive discipline in which various events might be distinguished in chronological order, recognizing how ones influence, condition or provoke others, forming thus contexts which allow understanding history. Times must be remembered in periods, in sequences, distinguishing the most relevant and contrasting events. The historic chronological sequence has been widely used as a means of systematic presentation of knowledge (Foreman & Gillett, 1997).

One problem that has been appreciated in students is that it is very difficult to create patterns of representation of time, because of its abstract nature, in which there is a lack of direct perceptive representations (Hodkinson, 1995), which makes it difficult for children to conceive events in a sequence of temporal order (Partington, 1980). The present time is a particularly important point of reference for the student, as it signifies the historical episode in which he has specific references to form himself a representation of history, from his own history. Thus the learner can incorporate his own images, starting with the most familiar ones, so that the articulation of historical representations becomes clearly linked to his present. Pedley et al. (2003) investigated the use of personal time lines that were built with the visual images of significant events in the life of the students, which enabled them to a better understanding of the historical chronology.

We propose to develop an understanding of the basic principles that give sustenance and consistency to the comprehension of a historic structure, under axles of thematic structure. In this case, the thematic structure is based in a disciplinary approach, in which some of the basic scientific disciplines [astronomy, physics, chemistry, geology, biology and social sciences (anthropology, history, sociology, psychology, economics)] are displayed, situated and defined.

The idea is to use, as the thematic structure, the basic notions that constitute the scientific disciplines, through a historical projection. The program, *Kronos*, recognizes four major constituent and consecutive historical periods: 1) Astronomical times: origins of the universe and formation of the solar system. - 2) Geological times: evolution of earth and life. - 3) Human times: origins and evolution of mankind (social times). - 4) Present times: our current situation (today, here, you, me, us).

The program, *Kronos*, also works in four phases that constitute different approaches, based on the historical periods. In the first phase it is proposed to assess and analyze the origin of the phenomena that become the object of study of the different scientific disciplines of knowledge. The sequence begins with the origins of physic phenomena, with the constitution of matter and its properties, followed by the constitution of the chemical phenomena, with the origin of molecular compounds, and so on, situating them within the great historic periods previously indicated: 1) Astronomical times: the origin of the physical and chemical phenomena. 2) Geological times: the origin of the geological and biological phenomena. 3) Human times: the origin of social phenomena that social sciences study. 4) Present times: the origin of technological phenomena, product of scientific knowledge and human creativity.



The second phase presents the firsts contacts between humans and the different phenomena that have become the subjects of study of scientific disciplines (physical, chemical, geological, biological, social and so on), which led humans to benefit and get advantage of the phenomena that, eventually, developed into knowledge that allowed primitive men to generate emerging technologies. We could say that this is the origin of primitive technologies, and corresponds to the origins of mankind in prehistoric times. The purpose of the third phase is to analyze the beginnings of the comprehension and systematic study of phenomena as the emergence of scientific disciplines, by recognizing and quoting some of the greatest thinkers who were precursors of scientific thought and founders of the disciplines. *Kronos* gives as an example the cases of physics and chemistry. The events are listed in the order of historical occurrence. The final phase is to present the different phenomena as part of contemporary life, which are manifested in the major technologies, by quoting some of the most important applications of scientific knowledge that exist in present times, giving examples such as, in the case of physics: atomic energy, space technology, ICT and magnetic resonance.

Cox (1999) emphasizes the remarkable difference that exists between reasoning and understanding a representation of knowledge developed by another, and to plan and build a representation of your own. We propose giving the student, through *Kronos*, a functional structure of visual and concept representations to support and serve as mediator or mind-tool for the student to organize, build and present his own ways of conceiving and representing what he has understood, so to say: to promote a series of idiosyncratic representations.

Finally, the proposal is to invite students to share with their peers their own representations, both visual and conceptual, of the different historical moments. The objective is to open dialogues and debates, mediated by the diversity of their own ways of conceiving and representing historical moments. Representations made by the students must be shared and discussed among them, so that this interaction develops into the collective construction of further representations. As Masterman & Roger (2002) suggest, students should be taught to browse and select the most appropriate representations.

The idea is to provide a cognitive instrument as a structure for knowledge construction in a virtual medium, from Kronos, supported theoretical and technological proposals of concept maps (Novak & Cañas, 2008) that offer a scheme of historical presentation under two modalities: a visual one by means of images, and a concept one, by means of text. Authors like Novak (2002) have said, in relation with these issues, that the most effective way to develop representations is by constructing concept maps, which provide meaningful learning, understanding and retention.

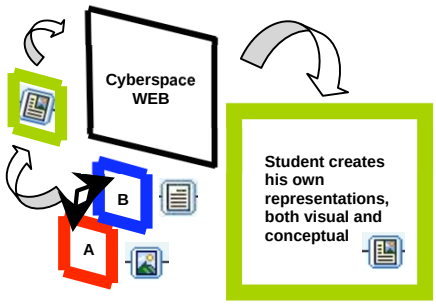


Figure 1. Kronos, promote the process for multiple representation

The objective is to generate representations that have a detonating effect on the constructive creativity of the apprentice, expressed within a field of digital resources (images, graphics, charts, drawings, text, pictures, diagrams, hyperlinks), so in such a way that the student interprets the representation and its meaning, and then develops his own ideas, navigates in the net and builds his own representation, embodied in a digital environment, using Internet hyperlinks.

The program *Kronos* is a system of multiple representations, interactive, articulated with hyperlinks to cyberspace sites. Through a visual representation (A), which creates links to a concept representation (B), a visual – concept card (AB) is created, which in turn contains channels leading to cyberspace through hyperlinks (Figure 1 shows the process).

Then students have to create their own representations, both visual and conceptual, by building a concept map.

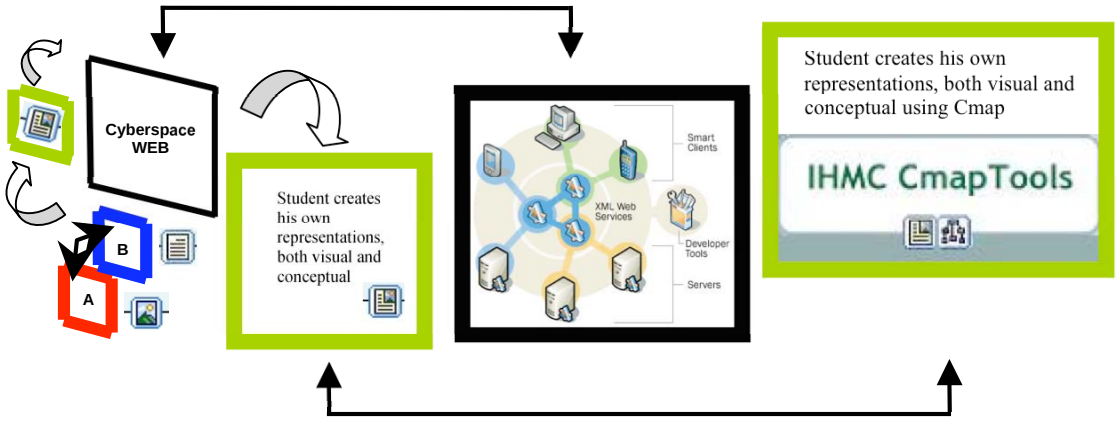


Figure 2. Kronos, the process for a system of multiple representations

The intention is to develop a cognitive instrument based on a computer program in which visual and concept processing is promoted, to traduce concepts into illustrations and illustrations into CmapTools in an interactive manner, either by browsing the Internet or by communicating with other students.

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