
HYPERMEDIA CONCEPTUAL MAPPING APPLIED TO FOREIGN LANGUAGE READING COMPREHENSION COURSES

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1. Abstract

Hypermedia Conceptual Mapping (HCM) is a tool used for modeling schemes to show concept relations that are created with the acquisition of new knowledge. From the interdisciplinary work of teachers working in the area of Computer Sciences and teachers working in the area of Foreign Languages at the Universidad Nacional del Sur, we found that the application of HCMs in English Language Reading Comprehension Courses can be an asset from the academic point of view. In this paper, we suggest a specific methodology for the development of these maps in the above mentioned context and the design of an educational experience programmed for assessing comprehension results in a university course.

2. Introduction

Hypermedia Conceptual Maps (HCMs), based on Novak's Conceptual Maps, are a valuable tool for improving significant learning processes. Hypermedia technology enhances this resource proposed from the field of Knowledge Sciences, going further into concept selection and hierarchy. The use of HCMs is valid for the teaching of any discipline and in this particular case we apply them to foreign language reading comprehension learning. In our case of study, we propose the use of this learning tool to naturally accompany the teaching process throughout the course, until the final evaluation.

We should emphasize that the creation of an HCM is not a trivial task. Classroom experience shows that, in general, students do not have difficulties in learning the technique itself. However, to obtain a semantically correct HCM they need to successively refine the map. The difficulty in the construction of the map means that they have not yet achieved a real understanding of the subject they are reading. If, for a given text, a student cannot determine main ideas, organize them in a hierarchy and formulate statements to link these ideas, basically, it means that the text was not understood, i.e. there was no meaningful learning. The contribution of HCMs to the teacher's work is also important, the map produced by a student gives a clear idea of his or her understanding of the text.

Within this framework, we are carrying out an interdisciplinary project in which, teachers from the Departments of Computer Sciences and Humanities – Area of Foreign Languages- are taking part. The work plan consists in performing a field experience for the subject "English Reading Comprehension Course. Second Level, Major: Natural Sciences". This course does not belong to the curriculum of any career in particular, the University offers it as

a service for all students and, at this second level, it has been divided into three different majors: social, natural and exact sciences.

1. 1. Hypermedia Conceptual Mapping

An HCM is a Conceptual Map enriched by the contribution of hypermedia technology. The basic elements that form part of an HCM are the following: concepts, linking relations and views. A concept is “a regularity in events or objects named by some term”. Relations are linking words that join two concepts into one unit with semantic meaning having the value of truth. These semantic units are called clauses [13].


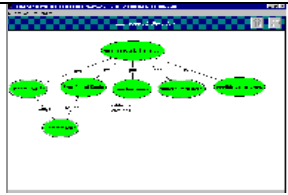

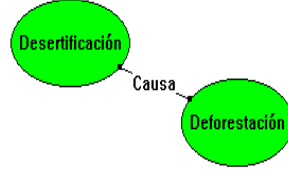

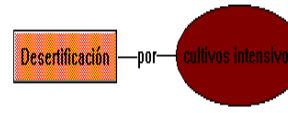
Both concepts and relations are the basic builders of a traditional conceptual map and are used in an HCM. However, the view is a builder that belongs only to HCMs. Regarding the structure, an HCM is a hypermedia document. Each hypermedia node, called view, has a collection of concepts and relations. Each view can be displayed in its own window and is characterized by a color and a name, by default the name of the most comprehensive concept that belongs to that view [17]. Views allow to divide the map into smaller units that can be handled from a semantic and visual point of view; this enhances analysis and focused perception activities.

The HCM organization into views made it necessary to distinguish three different types of representations for concepts: terminal, non-terminal and external concepts. From the semantic point of view, all these respond to the definition of a concept expressed by means of a noun or noun phrase. From the implementation point of view, a terminal concept is a self-defined concept within the view. A non-terminal button concept is a concept that explodes into another view, in which new concepts and relations that help its semantic description will be defined. An external button concept is a concept defined in another view that is imported in order to be able to establish a cross-sectional relation with one or more concepts of the current view [17]. In addition, examples or features can be added to terminal concepts. These features arise from associating a file which may contain sound, text, graphics or video to the concept. In Table 1, we can see schematic representations defined for each basic builder that can be used in the construction of an HCM.

The development of an HCM with the help of *hypermedia information technology* makes both the building task and, later, the reading of the map easier. The supply of a specific Platform with a graphics editor specially designed for HCM development with the basic builders for this model, provides a working environment that speeds up map creation and modification until achieving the final result. This tool for HCM development does not present difficulties regarding its use, even for students that do not belong to computer-related careers. The working environment was developed taking into account the requirements for frequent use window-oriented applications and it is characterized by its reliability and user-friendly interface.

This application allows for two work modes: author and reader mode. In author mode, a working environment with the necessary tools for building the map is offered. In reader mode, we can move around the map; in this mode, button concepts are the ones which allow us to navigate in the different views. The application gives the possibility of integrating all the HCM views in only one map as if it were a traditional conceptual map to which the color code and the different features were added for the representation of concepts. This integration, called Integrating Graph is useful for the final reading of the map in paper and the Platform, at the user's request, creates it automatically [7].

Table 1: Graphic Representation of HCM Builders

Concepts	Terminal		View		
	Non-Terminal		Relations	Internal	
	External			External	

2. 2. Application Methodology Proposed

The construction of an HCM results from the iterative process of concept selection, concept hierarchy, terminal and non-terminal concept identification, concept distribution into views, and linking relation definition among the concepts of the same view and among concepts of different views. This task of “organizing” concepts in an HCM is related to the other concepts of the same map and strongly depends on the approach used for a particular subject.

In a foreign language reading comprehension course, in our case English is the foreign language taught, students only develop reading skills in the foreign language. Their production (writing, speaking, listening) is in their mother language, Spanish. Therefore, they are asked to produce an HCM in Spanish as a final task to show their comprehension of the text. The development of HCMs is considered a task that requires little language and shows a great deal of understanding of the written text, therefore, it becomes a very useful tool for this type of course. Since the purpose of this course is to use English as a tool for the study of academic texts, tasks like this one also give practice in the sort of note-taking needed for study purposes. Thus, HCMs become the task of choice since other techniques that demand full understanding of the text, including the ability to distinguish between main points and examples, such as summarizing, has become unfashionable because it requires lucid and accurate expression, something that students lack. Another task that shows full understanding of the text is translation. However, we try not to request a translation since it involves other skills that students do not have at this level, such as a literal understanding of the text, a sensitive response and a high level of competence in both languages. Translation is thus a supreme outcome of the interpretation of a text, but makes great demands on the translator’s creativity and command of both languages, as Nuttall accurately states in her book [12]. Many students do not need the skill of translating and it is often beyond their capacity.

Let’s consider now, that we decide to implement HCMs so that students show their understanding of a text. Our aim, at this point, is to find the appropriate steps to guide students in the creation of their own HCM from a source text. Therefore, we suggest the following tasks:

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1. 1. Pre-reading tasks:
 - a. a. Setting overall purpose for reading the text. In this case, the objective is to achieve full understanding of the text.
 - b. b. Predicting and Previewing (This technique is used in most reading exercises so as to begin the actual reading with some ideas in mind. It becomes a great aid for comprehension)
 2. 2. While reading tasks:
 - a. a. Inferring unknown vocabulary
 - b. b. Understanding cohesion and coherence elements in the text
 - c. c. Selecting main ideas in each paragraph
 - d. d. Expressing those main ideas using nouns or noun phrases
 3. 3. Post-reading tasks:
 - a. a. Developing an HCM that shows full understanding of the text. This is achieved by following the ten steps that we propose next:
 1. 1. From the main ideas underlined in the text, select the most relevant concepts developed in the text.
 2. 2. Using the platform, present in an auxiliary view all the concepts selected.
 3. 3. Decide the number of views to be used. The number of concepts defined will give a general idea of the number of views that will be necessary. As a rule of thumb, we advise to have about 7 ± 2 concepts per view.
 4. 4. Classify the concepts into terminal and non-terminal button concepts.
 5. 5. Divide the set of concepts included in the auxiliary view in the different views that were defined.
 6. 6. Check the results with the text and make the necessary changes.
 7. 7. Begin the HCM construction with the concepts selected and according to the decision made.
 8. 8. Establish the relations among concepts in the same view.
 9. 9. Analyze the possibility for cross-relations and, in case you find them, import the necessary concepts as external button concepts.
 10. 10. Check again the map with the text and make the last necessary changes.

3. 3. Application example

In this section, we introduce a concrete application example for a text that belongs to the field of natural sciences dealing with the threats to arable land in our planet. The map was developed in Spanish language following the ten steps proposed by this methodology. For the sake of brevity, we do not show the intermediate steps followed until reaching the final result shown here. Figure 1 shows the original text from which the map was developed. Figure 2 shows the HCM with its four views: the first level corresponds to view No. 1, *Tierras Cultivables* (Arable Land); in this view four non-terminal button concepts were defined: *Cultivos Intensivos* (Intensive Methods of Farming), *Desertificación* (Desertification) and *Desforestación* (Deforestation), that respectively originate views No. 2, 3 and 4.

Regarding the appearance of the views under Figure 2, we can say that views No. 1, 2 and 4 are shown exactly as viewed in the reader mode, when visiting the HCM. View No. 3 is shown within the environment in author mode, in which we have the necessary tools for map construction.

It is possible to associate features and examples to terminal concepts so as to complete the definition. In our example, the concept *Construcciones* (Buildings) has two examples associated: *caminos and edificios* (Buildings and Roads). In this case, we did not use the hypermedia capacities of the platform, since this is not the purpose of the course, but which are available to be used in association to the concepts.

Figure 1 – Source Text: Threats to Arable Land

Arable land is currently under threat from many different sources. Every year, between 5 and 7 million hectares of good land are built on. Between 1960 and 1970 Japan lost no less than 7.3 per cent of its agricultural land to buildings and roads.

Soil erosion is also on the increase. In India, more than half of all agricultural land is subject to degradation. Some 6,000 million tones of soil are lost every year from just 800,000 square kilometers of land.

The use of intensive methods of farming is also leading to loss of organic matter in the topsoil and the buildup of both toxic chemicals and salts in the soil. At the current rate of land degradation, it is estimated, as much as one third of all good agricultural land could be lost within the next two decades. The problem is aggravated by the fact that so much natural organic fertilizer, instead of being returned to the soil where it is badly needed, has to be burnt for fuel.

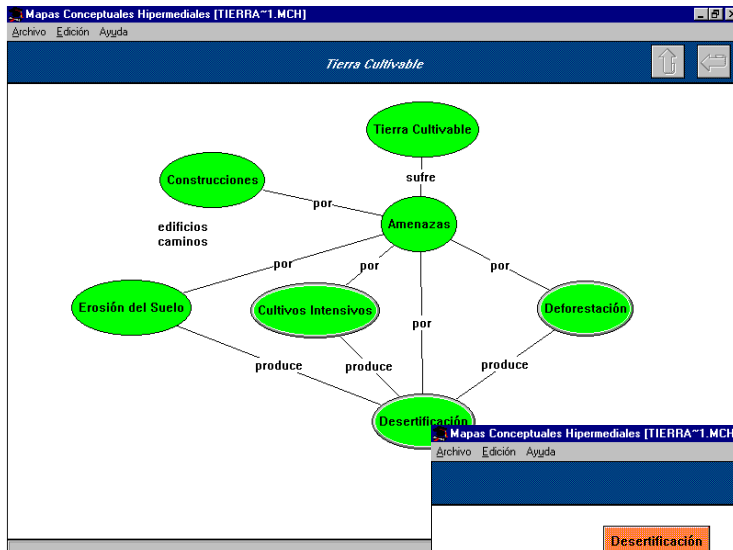
Desertification is one of the major problems. Aridity affects nearly one-third of the land surface. It is currently threatening the lives of the 80 million people who survive on the 19 per cent of the land under attack from desertification. Some 20 million hectares now deteriorate annually to the point where they stop yielding an economic agricultural return. The cost of the lost production has

been estimated at \$26,000m. a year.

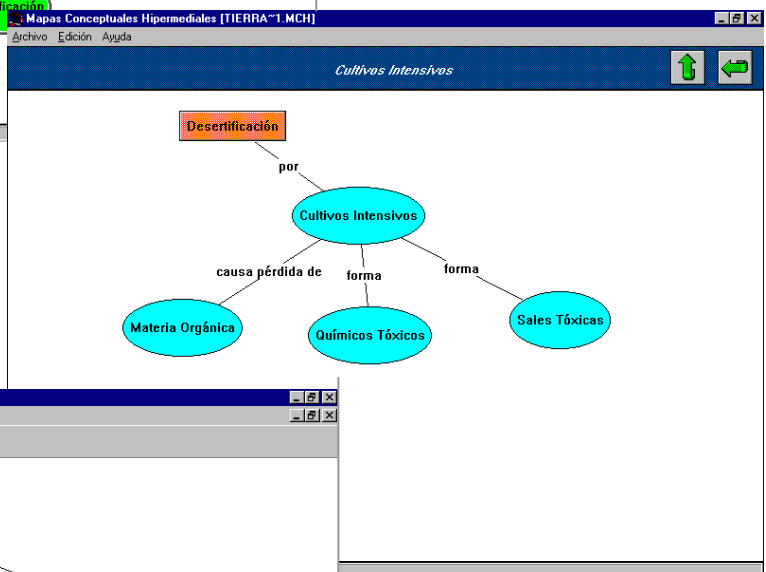
Desertification is not being produced by climatic change but by overcropping, overgrazing and salinization. It can also be produced by deforestation, which exposes soil to wind and rain, resulting in sudden soil erosion and flooding. But as the soil disappears so does the ability of the land to trap and retain moisture. The desert begins to get the upper hand.

The implications are serious. For one thing, deforestation inevitably adds to the carbon dioxide burden in the atmosphere, increasing the chance of climatic change as a result of the greenhouse effect. For another, the increasing scarcity of timber in tropical regions is leading to fuel-wood problems for hundreds of millions of people. And, finally, the forests contain most of the world's genetic resources, which are now under increasing threat.

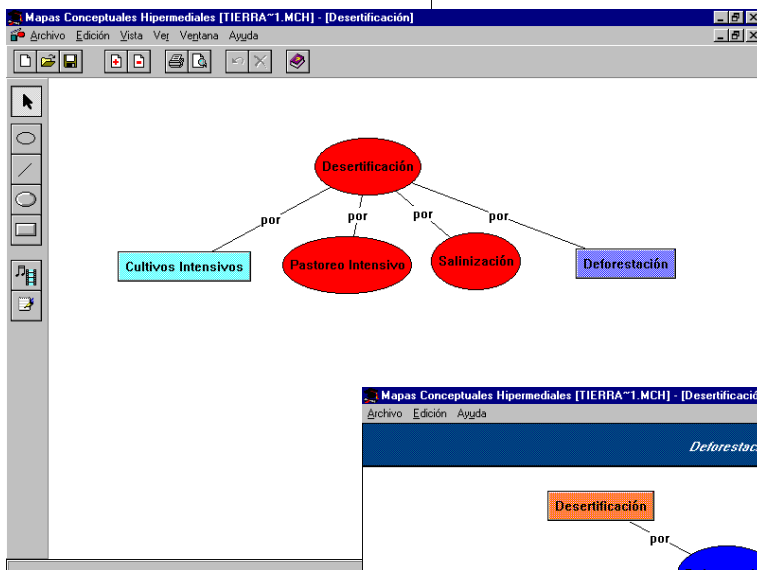
Figure 2 – HCM: Tierras Cultivables (Arable Land)



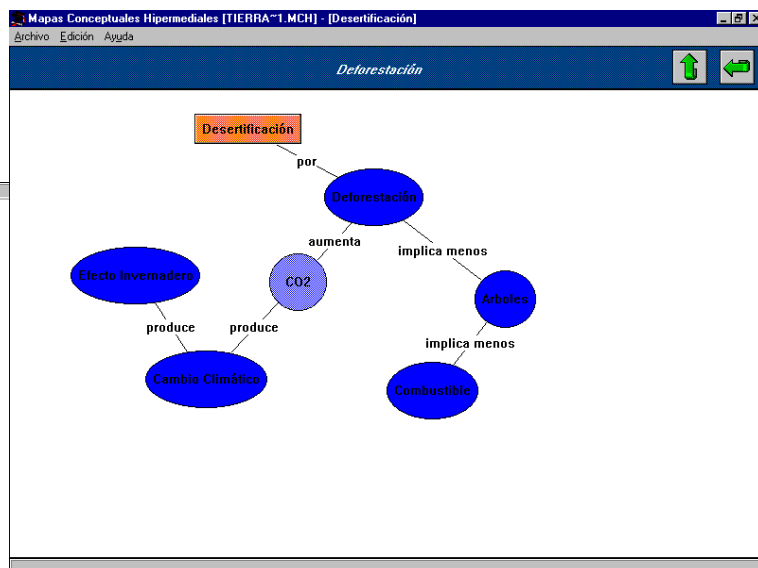
View No. 1- Tierra Cultivable



View No. 2 – Cultivos Intensivos



View No. 3- Desertificación



4. 4. Conclusion

In this paper we present HCMs applied to the teaching of foreign language reading comprehension courses and we set the first guidelines for the construction of the maps. We believe that this tool is very useful for this kind of learning, and an interesting alternative to show the comprehension of a text. The benefits of applying HCMs are two fold: for students, since the steps described to be followed by them for constructing the map will guide them in the process of text understanding, and for teachers, since they will be able to assess the level of comprehension achieved by the student, through the reading of the resulting map. At present, we are developing a pilot experience at a university course. By the end of such experience, we will be able to assess the academic results obtained. From the point of view of computing sciences, each application of the platform makes it richer with the addition of new functional requirements.

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