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WWMAPS, A COMMUNITY ON EDUCATION THROUGH COLLABORATIVE CONCEPT MAPPING

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Abstract. *WWMAPS* supports and coordinates educational practices and training initiatives focusing on construction of Concept Maps and shared Knowledge Models between students worldwide, through the universal language of Concept Mapping. During the nine months from the foundation, we have looked for technological solutions and partners, we have arranged web services, we have started up and monitored several collaboration teams in primary and secondary schools. Now we can evaluate these first results and study better practices for next and current collaborations. This paper is submitted to the Concept Mapping community to open a discussion about theoretical assumptions, goals, methodologies, difficulties and strengths to gain educational benefits from this kind of distance collaboration.

1 Introduction

Concept Mapping is now a tool of pedagogic mediation that facilitates meaningful learning. *Knowledge Models* (Cañas et al., 2003) arranged as structures of *Concept Maps* (Novak, 1984) linked among them outstandingly allow to organize complex fields of knowledge in a dynamic way. If both processes are implemented properly, they can have significant educational implications along the constructivist line. C-maps are more than graphic tool for the representation of already assimilated knowledge; they act as pedagogic, iconic and symbolic mediators, and visual-linguistic *organizers* which are able to shape paths, scaffolding individual or group cognitive processes. Moreover, the new technologies add value to Concept Mapping, in terms of motivation, flexibility and use, of opportunity of sharing and collaboration. Sustained on these pedagogical resources, we thought of undertaking an initiative that could stimulate the educational community for the use of c-maps.

Those who join the *WWMAPS* (World Wide Maps) community are encouraged to use concept mapping since their students will build and map knowledge domains in collaboration with distant students who speak a different language. In order to learn the basic language of concept mapping, few criteria are sufficient to be repeated in practice in a systematic and strict way to obtain immediate results. Motivated members in a community of practices "absorb" the criteria of building c-maps that are used within the community. We have inherited a shared model for concept mapping by a similar process of discussion as members of Italian community map.dschola (Guastavigna et al, 2004; http://it.wikipedia.org/wiki/Mappe_concettuali). These are the reasons why we have chosen this strategy, which, at the same time, gives a training environment and the certainty of achieving significant educational goals. The "learning by doing" method does not exclude the most traditional training methods. Advanced training initiatives like the one that are being implemented in Panama within the framework of project *Conéctate* (IHMC, 2005), show that it is possible to achieve a significant convergence between the two strategies, thus applying constructionist criteria in training and making the relative community play an active role.

2 Theory

C-Maps are made up of a network of basic propositions (subject– verb – object forming a meaningful semantic unit) whose structure does not change during translation. The hierarchical arrangement of propositions helps the reader make the difference between main and secondary concepts. Compared to the text where the same idea is often repeated and is often hidden by synonyms and metaphors, C-Maps are built with the least number of concepts and words, thus reducing complexity. Therefore, even if the reader is not an expert in the topic or has a poor knowledge of the language, s/he will understand the meaning and the context easier thanks to all these factors. For the same reasons the translation of a concept map is easier than the translation of a text having the same meaning and context. Concept Maps oblige to make clear and to elicit even those underlying conventional meanings which are shared within a local community such as a classroom. The students of a different class can read all significant ideas that are shown in the concept map. Moreover, thanks to technology (Cañas et al., 2004), a C-Map can be built by students from different countries as a shared working environment where resources – images, audio and video texts, web

pages, etc – are introduced to discuss about life experiences, culture or other contents. Therefore, thanks to C-Maps it is possible to set up significant communication and interaction with the least number of words.

2.1 Multilingual C-Maps

BiK-map (Bahr & Dansereau, 2004) gave us the hint to use maps, as the communication "interface" between two different languages. In Concept Maps relationships must be complete and detailed, thanks to explicit and exclusive phrases-links of every pair of concepts given. On the other hand, K-Maps have only nine kinds of labels that indicate general relationships (Characteristic of, Example, Leads to, etc.) Bilingual Knowledge Maps in well known contexts were successfully used to facilitate the learning of a foreign language. We think that complete bilingual C-Maps - with explicit link-phrases - are needed to communicate a complex knowledge, dealing with unfamiliar contexts, between pupils speaking different languages.

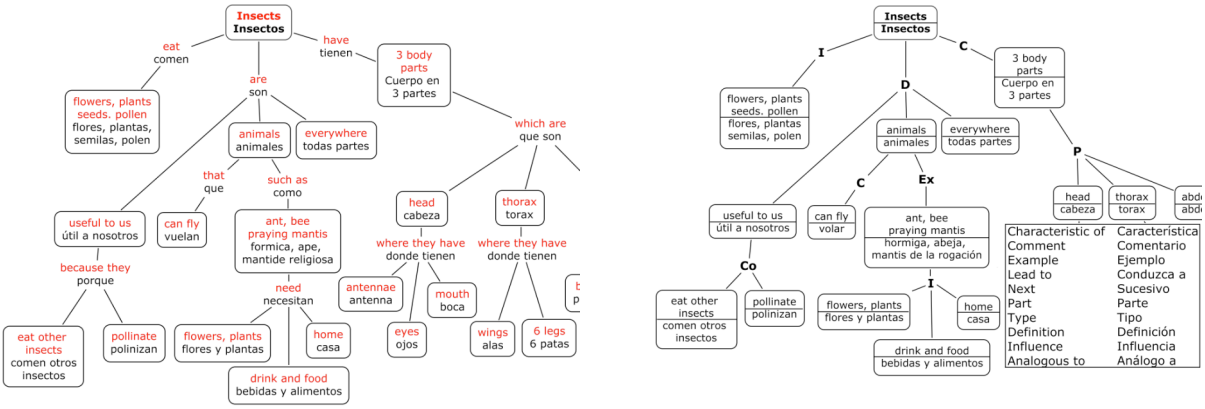

Figure 1. Comparison between a Bilingual Concept Map (left, excerpt translated from Michaela, six years old) and an equivalent Bilingual Knowledge Map (right). Linking phrases are hard to infer from coded links in unfamiliar contexts, particularly for Influence.

2.2 Collaboration through Concept Mapping

Project Quorum (Cañas, 1995, 2001) in the early 1990's in Latin America can be considered the first large scale experiment to take advantage of telecommunication links between schools and to demonstrate that meaningful learning can be encouraged through the use of concept maps. Coffey and Cañas (2000) affirm that in online distance education, interactive concept maps might be used as tools to produce effective learning. In fact, concept maps stimulate knowledge integration processes by making knowledge explicit, and by requiring the learner to pay attention to the relationships between concepts (Dutra & Fagundes, 2004). *CmapTools* is unique as a tool to establish collaborations and to share concept maps and knowledge models. Ortegano-Layne & Gunawardena (2004) envisaged that the CmapTools software could be used as a tool to foster online collaborative learning in distance education and realized the importance to provide training on how to collaborate using concept maps in an online environment. CmapTools and Concept Maps were chosen also as an instrument for resolution of conflicts (Beirute, 2004). It is admitted indeed that writing concept maps implies deconstruction and reconstruction of knowledge (as in conflicts) in a new hierarchical and impersonal structure of meanings capable to give a deeper understanding and an insight to that knowledge domain. So we can imagine practices where collaborative concept mapping, triggering negotiation of meanings, could be beneficial to learning (Basque, 2004).

3 Goals

WWMAPS has the following goals:

1. To disseminate Concept Mapping as an educational practice.
2. To share methodologies among teachers from different countries.
3. To increase the mutual knowledge of cultural realities in the world.

4. To build shared knowledge in disciplinary or professional (for teachers) domains.
5. To facilitate the learning of a second and third language.
6. To create the largest number of international collaboration teams.
7. To create a community on collaboration practices through Concept Mapping.

4 Methodology

Concept maps are the most "transparent" and efficient way to show and support, at a metacognitive level, the changes occurring when a student integrates new knowledge with the pre-existent one. In case of collaboration, knowledge will be shared within a work group having the same expectations as for the individual use of C-Maps. Moreover, the need for collaboration fosters the use of maps, thus strengthening the metacognitive tools the student owns.

4.1 How is a collaboration team set up

The teachers who know and are interested in the *WWMAPS* initiative connect to the "Join" web page http://www.2wmaps.com/public/participate.htm where they find the instructions to fill in the form with the data of students concerning the town, the age, their preferred topics of collaboration, the language etc. within a map called "MeToo". The successful entry of data in the appropriate box means that the potential member has downloaded and installed the necessary software (CmapTools v4), has learnt its basic functions and has a reliable connection to end the operation. Thereby s/he can join the community as a new member. Through the coordination of *WWMAPS*, the teacher interested in a collaboration comes into contact with a suitable pre-existing team or s/he contacts other teachers until partners with compatible characteristics are found.

Thereby every new team is set up according to a general topic although significant interaction among partners is necessary to change such a general idea in a clear-cut project: from highlighting specific topics up to focal questions that will start up the collaborative construction of C-Maps among students. Each team develops a "project map" in collaboration with a member of *WWMAPS* staff. Project Maps are similar to concept maps – sometime they are bilingual – although their syntactic structure is more flexible. Several solutions were adopted to keep trace of the path: nodes of different colours were used to make a difference among the authors of contributions, every time the versions changed they were saved with a legend to show the main changes. Nevertheless, team members used annotations. In some cases Project Maps are used as Home–Maps for knowledge models. Secondary-school students can also actively participate in the design and realization of the Home-Map. The team work is supported by an appropriate forum.

4.2 Collaboration among Students

In the design phase the schools and the groups of students to be involved get to know each other. At the same time students and teachers get familiar with the *WWMAPS* project and its tools (ex. tutorial on the use of CmapTools and on how good concept maps are built). Many students practice the foreign language when writing a personal description. This task can also be facilitated by using the "octopus self-intro" map (a map with eight tentacles, describing the pupil, attached to a root node with his/her portrait – name) which is easier to be customized and read than a text. The respective teachers will now coordinate students to start the works that will be worked out on parallel resources or carried out alternating work sessions on the same resource. The different forms of cooperation mainly rely on three parameters: *complexity, mutuality and autonomy*.

Complexity: evaluation of the frequency, degree of diversification of communication forms, of resources and representations of knowledge required to guarantee method and rhythm to the process of knowledge construction. Attainable complexity mainly relies on the age of the students involved and can be gradually increased throughout the process of team working experience.

Mutuality: It shows the degree of interaction and interdependence that students who collaborate must have. In order that distance collaboration makes sense, students should have a common task, share resources, examine and criticize partners claims, make common decisions, support and wait for each other as a condition to go ahead, celebrate together the outcomes. This is very different from working independently from each other!

Autonomy: independence of the activity from the coordination of tutors and teachers. Collaborating teams are based on the mutual work of students. Teachers contributes should vanish and their role should be limited to supervision and coordination, that comprises stimulation, encouragement, rising key questions, fixing technological problems, mirroring a positive sense of effectiveness and challenge in the progressing work. Furthermore, autonomy can be progressively enhanced by progressing experience and supported by a good preparatory training on C-maps.

Examples of collaboration methods	*possible required parameters* (1 = minimum, 2 = medium, 3 = high)		
	Complexity	*Mutuality*	*Autonomy*
1. Each partner develops its own map on a common topic and examine the work of the other. The exchange rises from the comparison, using annotations or discussion threads.	1	1	3
2. Both partners work on the same C-Map, editing it in turn, following rules to inform the other about the introduction and the modification of contents, but without sharing tasks. Explanations shall also require an exchange.	2	3	2
3. Both partners work on the same complex map or on the same knowledge model, suggesting and agreeing upon sub-topics to be developed. Links between sub-topics situated in different maps are also possible.	3	3	2

Table 1: Different types of collaboration and efficiency parameters required (just an indication)

Each class can be divided into more groups that can also be formed by each student who are "twinned" with other distant partners. All students or groups can work in parallel on the same topic or otherwise each unit in the class can deal with one or more particular aspects. Therefore, it is necessary to define the cooperating unit within the cooperation team, as a group of subjects coming from different countries who work on one single c-map.

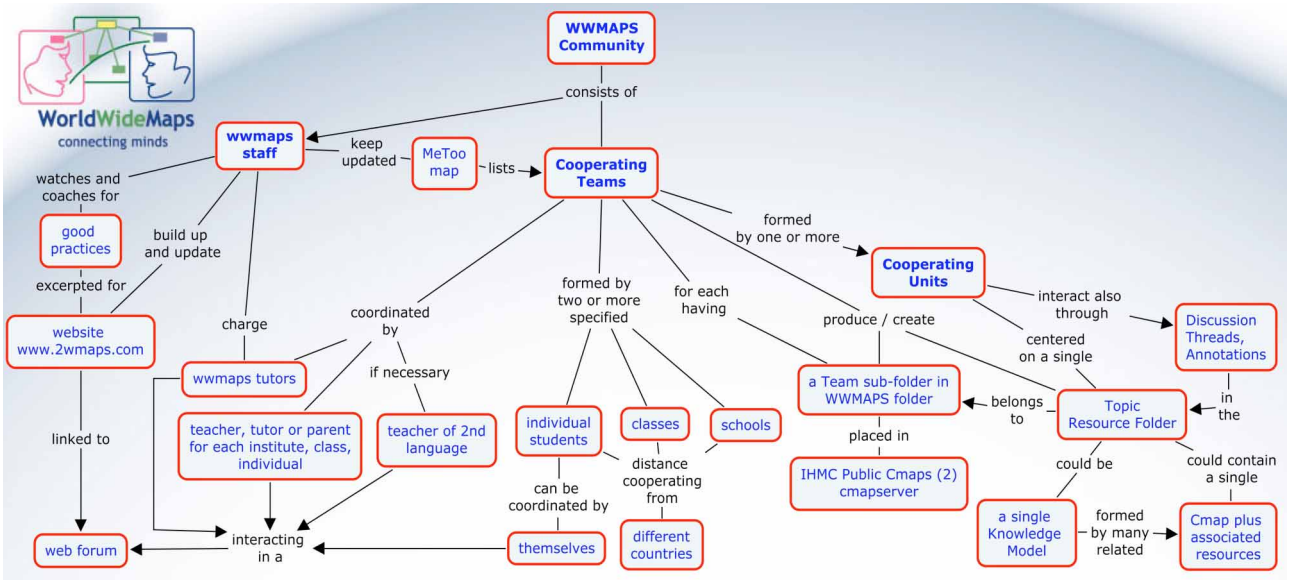

Figure 2. Structure and relationships in WWMAPS community

The choice of the most appropriate organizational solution and any change in progress are the topics of the coordination of each team, whereas the project staff deals with monitoring.

4.3 Which tools the technology offers to allow the collaboration

The CmapTools technology offers the possibility of sharing concept maps and other network resources. In this way it is possible to collaborate among distant partners and develop concept maps or more complex structures as knowledge models that modify and become bigger with new "branches". The simplest tool of discussion to make decisions on the work in progress that is also the most widespread one among started teams is the *Annotation*. For more complex discussions, *Discussion Threads* can be used by putting them in one of the main concepts in a map.

On the other hand we got round some of the limitations of *asynchronous collaboration* in CmapTools: as for the lacking of automatic chronology, where we save successive old copies using the number of the version (i.e. mapname_old01, mapname_old02 etc.), thus keeping the original name (e.g. mapname) for the most updated version. Notification of changes takes place in the respective forum of collaboration teams (where automatic e-mail alert is implemented). Another collaboration tool that can also be used in asynchronous method is the *Knowledge Soup* (Cañas et al,. 2001). The sharing of such a repository of claims which are independent from the context, rather than of a C-Map, enables the team partners to be more flexible and autonomous. They can choose the shared claims from the Soup, and enter them as unchanged or modified propositions in the map. However, the current technology is not fit for soups from bilingual maps; therefore the Knowledge Soup was tested only for maps in a common language or within the same partner. As for the collaboration method n.1 (Tab. 1) the use of the Knowledge Soup would increase the interdependence and mutuality level among partners. Asynchronous collaboration best suits working rhythms of partners who generally add their contributions weekly and in different times. However, the CmapTools technology also permits *synchronous collaboration*. Accordingly, distance training micro-activities could be carried out with the same efficiency as classroom lessons which are very useful to harmonize the skills of team members at the beginning of the collaboration.

5 The first results

The teams worked autonomously and developed the collaboration process by keeping contact through e-mail and autonomous forums. The first phase consisted in realising auto-presentation maps of the schools, the classes, and the students. Then, once defined, the general topics were divided into project maps and assigned to groups of students coming from different partner classes. Afterwards, the students began to build the maps and to connect resources in different cooperative forms.

After only a few months of activity, different teams started to collaborate (interact) with students and to produce a large number of maps and knowledge models which are opened to further development, like open building sites. It is difficult for even one of these processes to find enough space in this article, therefore, we will limit ourselves to a synthesis chart (current status of the teams is accessible from www.2wmaps.com/Eng.htm, link "keyhole").

Team	**Partners**	**Topics; *Development stage***
AntAna	Italy, Spain; P.S.	Knowledge of the countries and of the traditions; *Compared maps*
CoBeCast	Italy, Costa Rica; P.S.	Dying or at risk species of animals, Compared and *Shared C-Maps*
ItEspa	Italy, Spain; P.S.	Citizenship and Human Rights; *Shared C-Maps*
LaBeMal	Italy, Malta; P.S.	Citizenship and Human Rights; *Compared and Shared C-Maps*
MalToBe	Italy, Malta, Spain; P.S.	Science: materials and their properties, recycling, concept of interaction; *Compared and shared C-Maps; shared Knowledge Model on physical-chemical interaction*
PanamBe	Italy, Panama;P.S.	Knowledge of the traditions*; first shared c-map on Christmas*
ReLaCo	Italy, Costa Rica; P.S.	Intercultural exchange from ancient civilizations, alimentation, body health; *first C-Maps to compare.*
Physics	Italy, Romania; S.S.	Forces, Measures; *Compared C-Maps; K-8 constructed c-maps that was reviewed by K-10 students*
Physics 2	Italy, Romania; S.S.	Light theories; *Training starting from skeleton C-Map, knowledge model on photoelectric effect*
StoryMath	Romania, Mauritius; S.S:	applications of geometry in different fields (art, biology, architecture, etc.) and historical development of mathematics; *Eight C-Maps on History of math by students from Romania; searching for a new partner.*

ZaSeMa	Italy, Mauritius, Spain; S.S.	Water management; *Collaborative knowledge modelling*
ZaSs	Italy, Spain; S.S.	European Union*; Collaborative knowledge modelling*
Synapsis	All partners expert in educational psychology	Psychological aspects of learning and teaching; *Collaboratively developed expert C-Maps becoming a knowledge model.*

Table 2: description of *WWMAPS* teams from primary school (P.S.), secondary school (S.S.) and expert adults

Below an example of concept map developed collaboratively in an asynchronous way by the team LaBeMal.

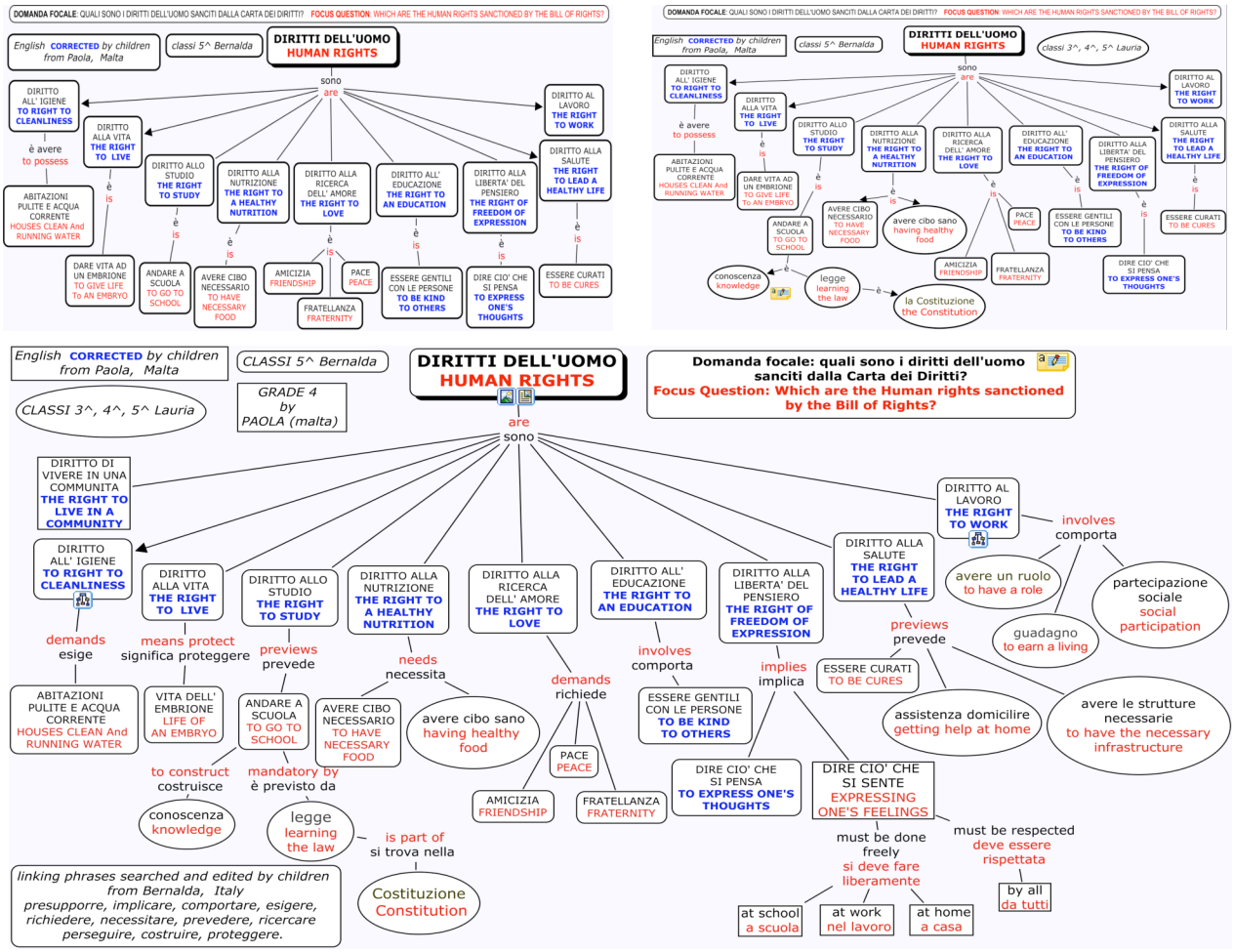

Figure 3. Two intermediate phases and the current version of a collaborative C-Map from team LaBeMal. Translation by children. Italian children searched for accurate linking words from synonyms dictionary and fitted them.

6 Evaluations and future program

The evaluation of the cases, based on monthly reports from the staff coordinators of each team, and of this whole experience, is still in progress. A first evaluation concerns the duration of the collaborations which depends on the following factors:

1. school calendars of the partners do not coincide. The students must wait for the end the each other's vacations to resume their collaboration. This is the case for the collaborations between Italy and Panama (PANAMBE), and between Costa Rica and Italy (COBECAST e RELACO).
2. experience of concept mapping by the team's partners. Teams constituted by experts in concept mapping spend less time to begin and realize the work, while less skilled partners need a gradual approach to get used to the software and to the CM methodology.

Other ”building sites” become less productive when the initial spur fades because of the “exhaustion” of the fixed arguments or because of the preference of a partner for another team. Such situations require both good timing for the collaboration between students and its development in a short period of time. In any case the collaboration between teachers should carry on without any fixed deadline with the alternation of different groups of students. In fact, the purpose of *WWMAPS* is to consider both the cooperation between students and the sharing of methodologies between teachers. The latter will be fruitful only in a long period of time.

For the future we will try to combine partners with a similar experience in concept mapping. The less experienced once will have a tutor who will not be involved with his/her students in the same team. As for the more qualified partners who will experience higher forms of co-operations (e.g. knowledge soup, synchronous collaboration), we rely on the Instituto Educativo Moderno in Costa Rica (www.iemonline.org) and on the schools supporting the Proyecto Conéctate al Conocimiento (IHMC, 2005), that has a strategic importance in Panama and that is already included among our collaborators.

As we anticipated, the multilingual concept maps have been quite easily translated in two and three languages by the students who even expected their partners to correct the mistakes, and have been used as effective interfaces to communicate complex knowledge (such as about the photoelectric effect, human rights, functioning of European Community, waste recycling, etc.) or to compare geographic mountain ranges, the extinction of animal species, religious and popular traditions and political – social organization of different partner regions - cultures. In the case of the team Italy-Spain, “ZaSs”, the translation of the knowledge model on the European Union has been made a lot easier by sharing the multilingual portal http://europa.eu.int, suggesting us a general strategy of sharing multilingual websites as common team bases of research.

The successful short training in *Physics 2* team demonstrated the need of another resolution for beginner-level teams, consisting in exercises to learn how to build good C-Maps, before dealing with the decided themes.

An advanced *constructionist model* for the collaborations should be attained, in which the role of a coordinator teacher, besides being a support in the collaborating group, must aim at controlling the processes and helping students to became autonomous in their achievements. The students have their own ideas on many things, for example on political elections. Therefore, they should have the possibility:

1. to elicit their prior knowledge in building basic concept maps that we can call “cognitive matrices”;
2. to commit themselves into critical confrontation. To become more aware of the differences and of the richness of the experiences, to start processes of comparison, negotiation of the significations, differentiation, extension and generalization. All spurred from the wish to see what the students of their age from other countries do and how they live the experiences about the subject and how they represent them;
3. to start a meta-cognitive phase through the reconstruction and synthesis of knowledge together with new revisions, with selections, with hierarchical organisation of concepts, and common decisions on how to structure the work. The children must be aware that this third phase must be *always* realised, in which knowledge must be systematized, and that the work cannot be done by others for them.

It is obvious that this really constructionist model of education is incompatible with an objective-based pedagogy because the realistic target is something that becomes clear on the way, depending on the effective possibilities of the class and of the instructional context. This is how we intend to respect the teacher’s professional autonomy, by entrusting her/him with the responsibility of the educational relationship an not by using other ruinous deterrents.

7 Conclusions about the main goal

The wealth of our community derives from the variety of collaborative solutions experienced in the single teams. The consolidation and the maturation of the *WWMAPS* community demand but an ulterior effort so that discussions, debates and comparisons do not remain limited to the dynamics within the single teams if we want to add a further level of true collective discussion. One of the greater obstacles for the attainment of this goal is due to the linguistic difficulties of many members, although they all are good teachers and trustworthy as collaborators. For this purpose we will try to use shared multilingual concept maps to focus the common debate on the methodologies, on the

constructionist approach to distance collaboration through concept maps, and on the training for reliable concept mapping. Such strategy should increase the levels of interdependence between members, allow an effective comparison and review of the practices, foresee which direction the project should take and, after all, assign a role of reference to *WWMAPS* in the scene of the practices on collaborative education.

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