

ATINER CONFERENCE PRESENTATION SERIES No: EDU2016-0046

**ATINER's Conference Paper Proceedings Series**

EDU2016-0046

Athens, 14 March 2018

**Concept Maps As Facilitative Tools in Online Learning Context**

Maria de Fátima Goulão

Athens Institute for Education and Research

8 Valaoritou Street, Kolonaki, 10683 Athens, Greece

ATINER's conference paper proceedings series are circulated to promote dialogue among academic scholars. All papers of this series have been blind reviewed and accepted for presentation at one of ATINER's annual conferences according to its acceptance policies (<http://www.atiner.gr/acceptance>).

© All rights reserved by authors.

**ATINER's Conference Paper Proceedings Series**

EDU2016-0046

Athens, 14 March 2018

ISSN: 2529-167X

Maria de Fátima Goulão. Assistant Professor. Aberta University. Portugal

**Concept Maps as Facilitative Tools in Online Learning Context**

**ABSTRACT**

Our study aimed to understand how the use of concept maps it is perceived, as a working method in the construction of individual knowledge and in helping to collaborative work, for a student group in online system. The students worked over a semester with this approach. At the end of the semester it was requested for them to answer a questionnaire regarding the relevance of the concept maps in individual or team work. The questionnaire was composed of 3 parts. Preliminary results of this study indicate a positive evaluation of concept maps, particularly in the construction, representation and organization of knowledge. They help to simplify complex realities, promoting collaborative work and learning.

Keywords: Online learning; concept maps; adults learning; learning process

## **Introduction**

The online contexts appeals to the autonomy of the learner in the construction of knowledge. The teacher has a very important role in designing environments that are appropriate for the development of this competence. Furthermore, the proposed tasks, and the methodologies as well, have a significant impact on the achievement of this goal.

Technology by itself does not guarantee that the information is transformed into knowledge. It takes all the effort of organization's learning environment so that it meets the learners' needs/characteristics, and the training objectives. The search for activities and challenges that promote this construction of knowledge, and different forms of interaction, should be a concern in the construction of learning environments. According to Goulão (2015) (...) *Learning in digital environments allows the use of resources and tools that enable interaction and networked, collaborative learning* (...).(p.4)

## **The Context**

In this section we will talk about some aspects that we consider important inherent in the context in which develops learning, as well as some characteristics of students who are learning this system.

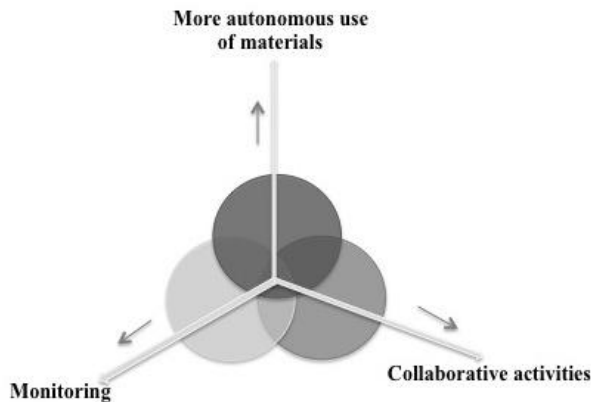
### *Online Learning Environment*

Initially the information and communication technologies, and subsequently, the development of Web 2.0, opened the door to new scenarios for education. The technology allows quick, distant, and asynchronous access to information. In addition to overcome geographic barriers, it promotes equal access for those with physical constraints.

Besides these factors, there are others which enhanced the fast development of these systems, such as, the continuous changes in our society that require skills acquisition and / or updating to meet the challenges that arise.

It is in this context that the online education emerges and wins its space. According to Pachler and Daly (2011) the concept of online learning is that (...) *learning takes place at a distance from formal classrooms and its facilitated and supported by web-based technologies* (...). (P. 11). The changes are felt at various levels: in terms of the courses' content and curricula, the flexibility of its construction, and distribution. It also assumes new resources for teaching, new ways to work, to communicate, and to collaborate (Goulão & Henriques, 2015). In this sense, we can analyze a formative action based on 3 axes: materials (content)/monitoring/activities, as described in Figure 1.

**Figure 1.** *Axes of a Training Activity*



This figure seeks to portray the dynamic we can find in a training activity depending on our objectives, and consequently, our position in the different axes. What we want to clarify is that, in this perspective, relationships and interactions that take place within the learning teaching process are changed. There is a change in the pedagogical relationship. The roles of each actor in this scenario should be rethought. Christen (2008) tells us about the needs of 21st century learners and now the technology’s potential should be considered in the promotion of “*interactive environment learning and (...) instructors also can take advantage of the networked classroom to collaborate more closely with their peers (...)*” (p.2).

In order to do this, we must select motivating and flexible methodologies, which integrate different teaching resources, dynamic and interactive content, where the communication channels and working ways can be diversified, and where students have the possibility to choose itineraries, activities, and methods that are more compatible to learner’s individual characteristics.

Learners find that, in this format, there is a greater flexibility that allows them to achieve objectives that otherwise were unreachable. Acquisitions are located at different levels: a formal knowledge level and a personal level; with the development of their autonomy, their critical thinking, and collaborative work.

In online learning context, the emphasis is placed on the idea that the learner is the builder of his knowledge, carrying out in the whole process an active role. Students know now to plan learning from analysis of requirements and manage the process in order to achieve their own goals. They know how to identify the appropriate types of intellectual operations, chose the best teaching methods and materials that best suit their learning style, and, finally, know how to make decisions and to ask questions that allow them to advance and assess developments. This active role enables the learner to be observant and intervenor in to learning context, setting goals, and acting to achieve them.

By monitoring, learners can check how plans become actions and reflection on their progress, learners can realize the discrepancies between their goals and their achievement. Thus, learners can exercise metacognitive control, reviewing

targets, adapting plans or changing operations (Winne & Nesbit, 2009). According to Serra and Metcalfe (2009), the concept of metacognition have been associated to the following aspects: knowledge about the process, about its monitoring, and its control.

The learning process leads to a continuous evaluation of itself and a consequent decision on what to do with the information collected: What is next? Is there need to study more? How should I study this content? What strategies am I going to use? (Goulão, 2009).

Learning requires the learner to give a functional meaning to their learning. He must be aware of its structure, its importance, and especially its usefulness.

This awareness of the processes, by which the learner exercises control or a self-regulating activity when solving a problem, is extremely relevant for true learning, and allows for greater transferability not only of knowledge but also of skills.

The studies point to the importance of metacognitive strategies in self-control. These play an important role in self-regulation of learning, by providing students information to enable them to make decisions on learning tasks.

The ability of self-regulated learning is an important factor to overcome procrastination. This importance is increased when we are in online contexts, to provide information to teachers that seek to develop strategies that help reduce procrastination and make learners more self-regulated.

According to Pachler and Daly (2011) self-regulation, and how it links to motivation and emotional factors, must be considered as the crucial aspect of learning (p.29).

Reflection on the learning process itself is crucial to promote students to monitor their actions and, thus, to become more effective learners. In order for the teacher to organize tasks, map out strategies to promote learner its autonomy, its reflection, and self-regulation of learning.

## **Concept Maps**

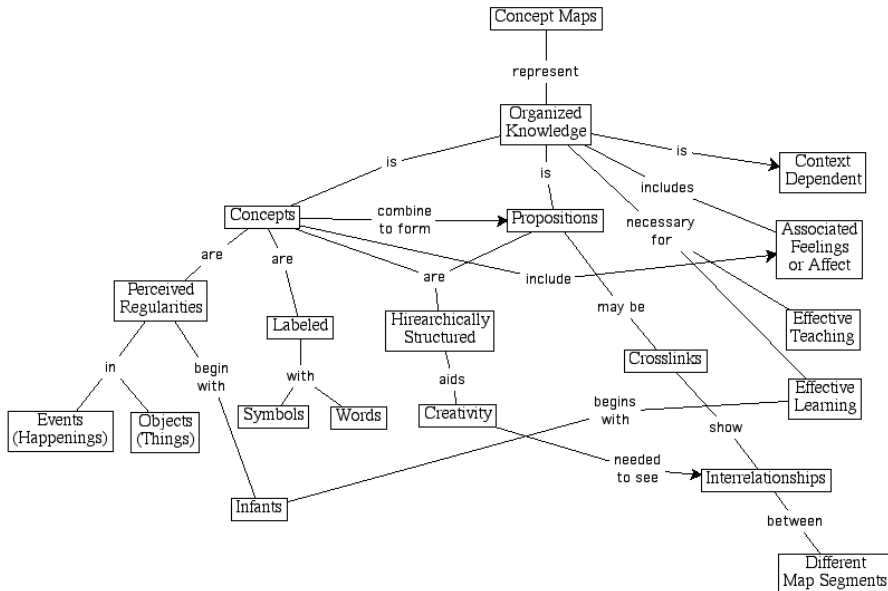
In this section we will, at first, revisit the concept of Concept Maps, its characteristics and aspects to take into account in its construction. Secondly, we will address the issues related to learning.

### *Characteristics and Implications for Learning Process*

Concept maps consist of nodes that represent concepts and links that represent relationships between concepts in different segments or domains of the concept maps. The concepts are represented in a hierarchical way. It's a multi-sensory tool that uses visuo-spatial orientation to integrate information, helping students while organizing and retaining it. The use of different dimensions as images and colors facilitates memorizing and achieve several learning styles. Concept maps play a very important role in representing and building knowledge. Ie, concept maps help in the construction of meaningful

learning (Novak, 2000). They aim to organize ideas, seeking to highlight the main concepts inherent to a particular topic, the connection between them, as well as the sense of hierarchy starting with a focus questions (p.4) (Cañas & Novak,2008) – Figure 2.

**Figure 2.** A Concept Map Showing the Key Features of Concept Maps



Source: Cañas & Novak, 2008, p.2

Another advantage of concept maps is that they can be built over time allowing the incorporation of new ideas and concepts as a field is being studied and information becomes knowledge. This role is reinforced when we are working with students in e-learning due to its ability to help organizing the knowledge and to facilitate the construction of collaborative work. At this level, it promotes discussion and negotiation among the participants of the team leading to a collaborative process of knowledge construction.

Collaborative learning, in an educational perspective, involves groups of learners, working together with a common goal: to solve a problem, to complete a task, etc. According to Smith and MacGregor (1992) collaborative learning implies a cooperative intellectual effort of all members in order to find the meaning or the solution to their problem or their task. There are several collaborative ways and tools to support such activities, and the conceptual maps are one of them.

## Methodology

### *Objectives*

Our study aimed to understand how the use of conceptual maps is perceived as a working method in the construction of individual knowledge and in helping collaborative work.

### *Participants and Design*

Data collection was made through questionnaires and occurred at end of the semester. A total of 21 postgraduates' online students participated in the survey, as volunteers; 28.6% males and 71.4% females; the average age of the participants was 41, ranging from 27 and 58 years old. Two students were in their 20s, 6 students were in their 30s, 8 students were in their 40s, 5 students were in their 50s.

Our study focused on postgraduate courses, taught entirely online. The students worked over a semester in two ways: maps were either prepared in groups, or individually.

### *Instrument and Procedure*

After reading the basic texts for each of the themes, students performed their concept maps. In some situations individually, others in groups, according to the proposed work. Concept maps were posted on the Forum theme to be analyzed by peers and by the teacher, and serve as a basis for discussion in the virtual class.

**Table 1.** *Structure of the Questionnaire*

<b>Parts</b>	<b>Objectives</b>	<b>Characterization</b>
0. Identification	Sample characterization data	<b>Four</b> questions about Age/ Sex/ Type of training/ Experience in the use of maps
1. Relevance of their use ...	Aspects related to the implications of the use of concept maps ( <i>The Concept maps are relevant as a way to ...</i> )	<b>Eleven</b> statements Their opinion on the scale 1-5 1 = Not relevant 5 = Very relevant
2. Design and Construction	Aspects related to the individual and teamwork. General aspects and evaluation	Four questions. Three of them are open questions about individual and teamwork. General observations.
3. Evaluation	Overall evaluation of this form of work concepts	One about the general evaluation to this kind of instrument of work. Their opinion on scale 1-5 1 - Not useful / 5 - Very useful

At the end of the semester it was requested for them to answer a questionnaire regarding the relevance of the conceptual maps in different aspects, including the construction of knowledge. The questionnaire had 3 parts. Part 1, subject identification; Part 2, set of 11 statements with a scale of 1 to 5; and Part 3, Design and Construction of maps (Individual, Team and Notes), open answer – Table 1.

## Results

We will present the results taking into account the objective of our research and following the three parts of our questionnaire.

*Part 1- Relevance of their use ...*

We are going to start by presenting the results in each of the statements - Table 2

**Table 2.** *Results by Statement in a Global Sample*

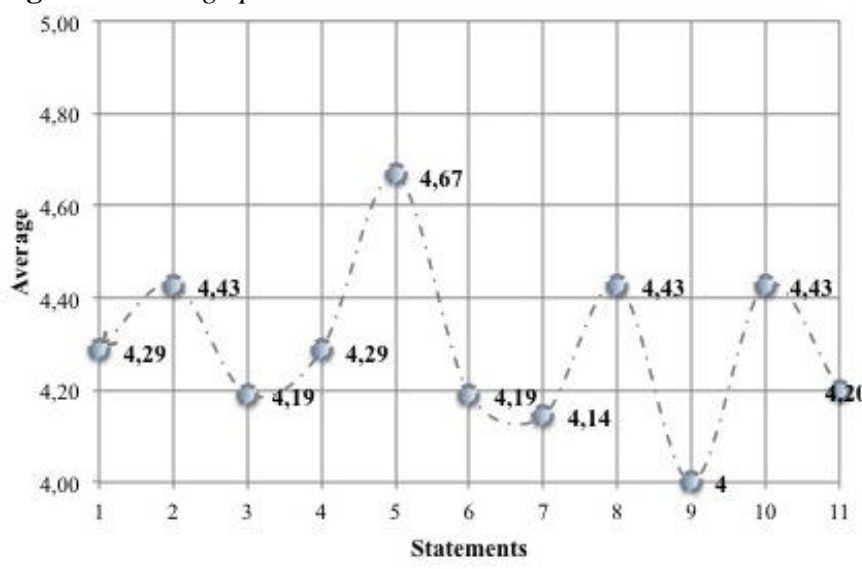
Statement	Scale (1–Not relevant / 5 –Very relevant)				
	%				
<b><i>The Concept maps are relevant as a way to ...</i></b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
<i>1. ... Building knowledge</i>	0	0	9.5	<b>52.4</b>	38.1
<i>2. ... Represent knowledge</i>	0	0	19	19	<b>61.9</b>
<i>3. ... Develop critical thinking</i>	0	0	23.8	33.3	42.9
<i>4. ... Develop creative thinking</i>	4.8	0	9.5	33.3	<b>52.4</b>
<i>5.... Organize information / content</i>	0	0	4.8	23.8	<b>71.4</b>
<i>6. ... Sharing information / content</i>	0	4.8	14.3	38.1	<b>42.9</b>
<i>7. ... Compare the information / content</i>	0	4.8	19	33.3	<b>42.9</b>
<i>8. ... Simplify complex realities</i>	0	0	14.3	28.6	<b>57.1</b>
<i>9. ... Promote collaborative work</i>	0	0	28.6	<b>42.9</b>	28.6
<i>10. ... Promote learning</i>	0	4.8	9.5	23.8	<b>61.9</b>
<i>11. ... Learning online</i>	0	0	20	<b>40</b>	<b>40</b>

The results presented in table 2 emphasize the use of conceptual maps for this group of students as a tool to organize information/contents, represent knowledge, simplify complex realities and develop creative thinking, which promotes learning.

Figure 3 shows the mean obtained in each of the eleven statements. The average found suggest a very high level of agreement with the ideas expressed in the sentences. That level of confidence is more evident in statement 5 (*The Concept maps are relevant as a way to ... Organize information / content*)



**Figure 3.** *Average per Statement*



*Part 2. Design and Construction*

When asked to List the main difficulties encountered in the realization of concept maps in an Individual way, selecting relevant information and systemizing ideas are the main difficulties. When asked about team work (List the main difficulties encountered in the realization of concept maps in terms ... teamwork), student's pointed out management of individual divergences, understanding ideas coming from different elements and create consensus.

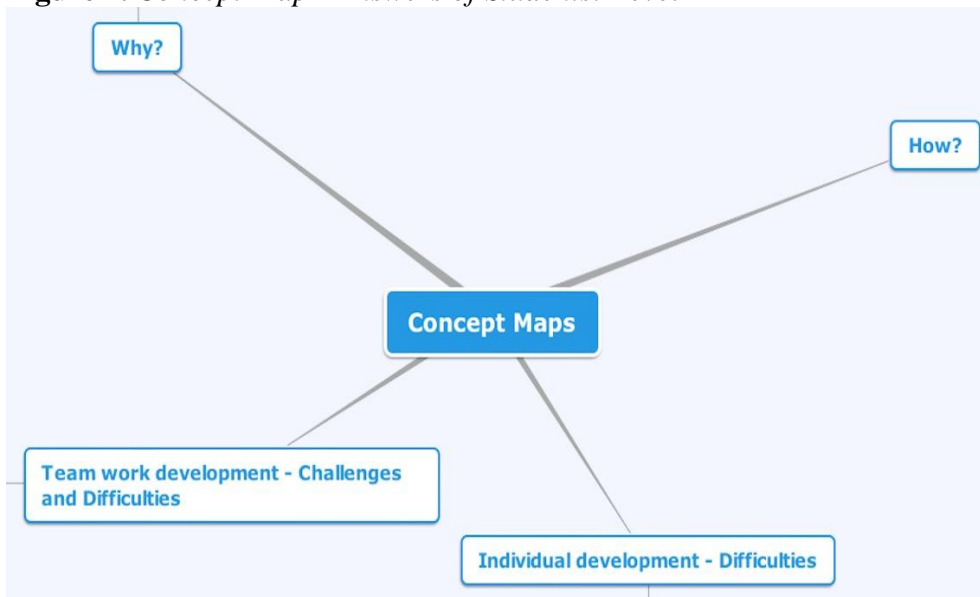
In the space dedicated to observations that was a great consensus about the importance of using this type of tool and its consequent implication in the learning process. The visual aspect of conceptual maps is mentioned, ie (...) the execution of a written plan of symbolic nature, signage, allowing quick viewing "mental" association and connection of concepts, allowing a global "key" pictorial about the issue in discussion.

Thus, the analysis to the open question can be addressed on two levels: *Indicate the main difficulties encountered in achieving the conceptual maps in terms ...*

- a) Individual task*
- b) Team task*

The first is shown in Figure 4.

**Figure 4.** Concept Map - Answers of Students: Level 1



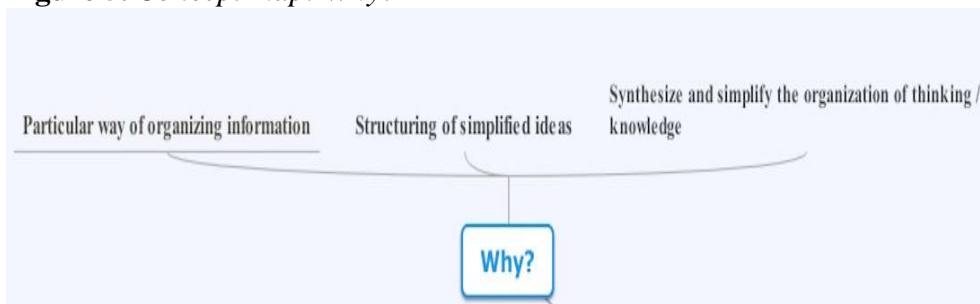
Students' responses refer to 4 large items. *Why?* welcomes arguments relating to the reasons to use of concept maps; *How?* indicates how the preparation of maps is undertaken (precautions) *Individual development!* It addresses the difficulties encountered in the individual realization of this type of activity taking into account two perspectives.

*Team work development!* It brings together the arguments used by students to carry out this work modality

Each of these items can be operated in a graphical form, as follows:

*Why?*

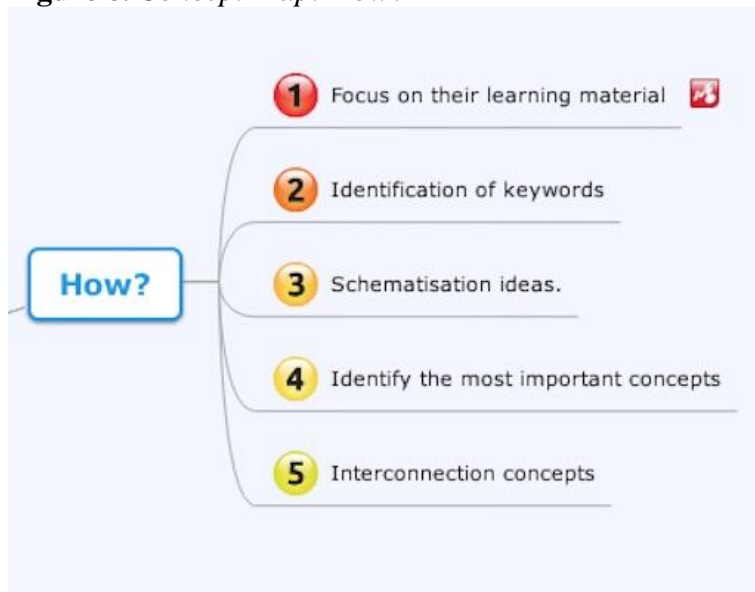
**Figure 5.** Concept map: *Why?*



Here we find the main features and objectives of a concept map, as we saw in section 3.1.

*How?*

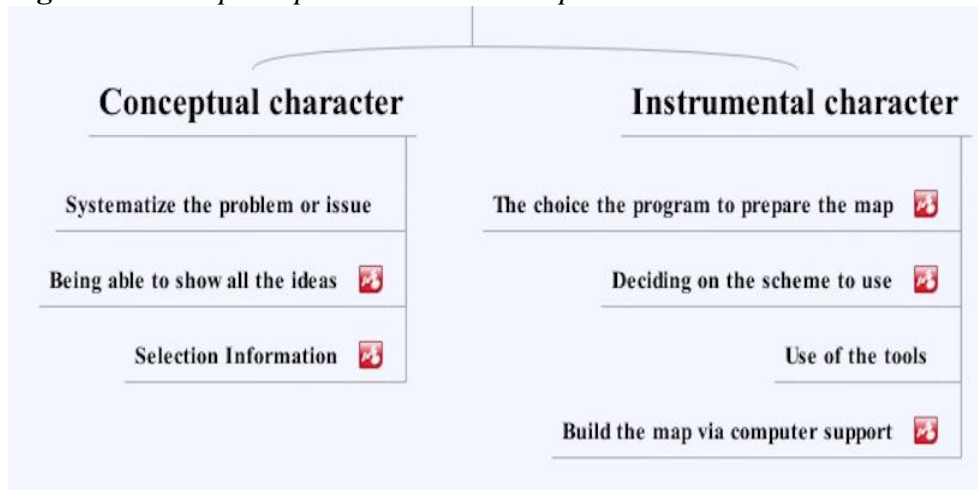
**Figure 6.** *Concept Map: How?*



As in the previous item, the responses of students will meet the guidelines for the construction of concept maps. That is, they can identify the essential aspects to be taken into account to build a conceptual map.

*Individual Development!*

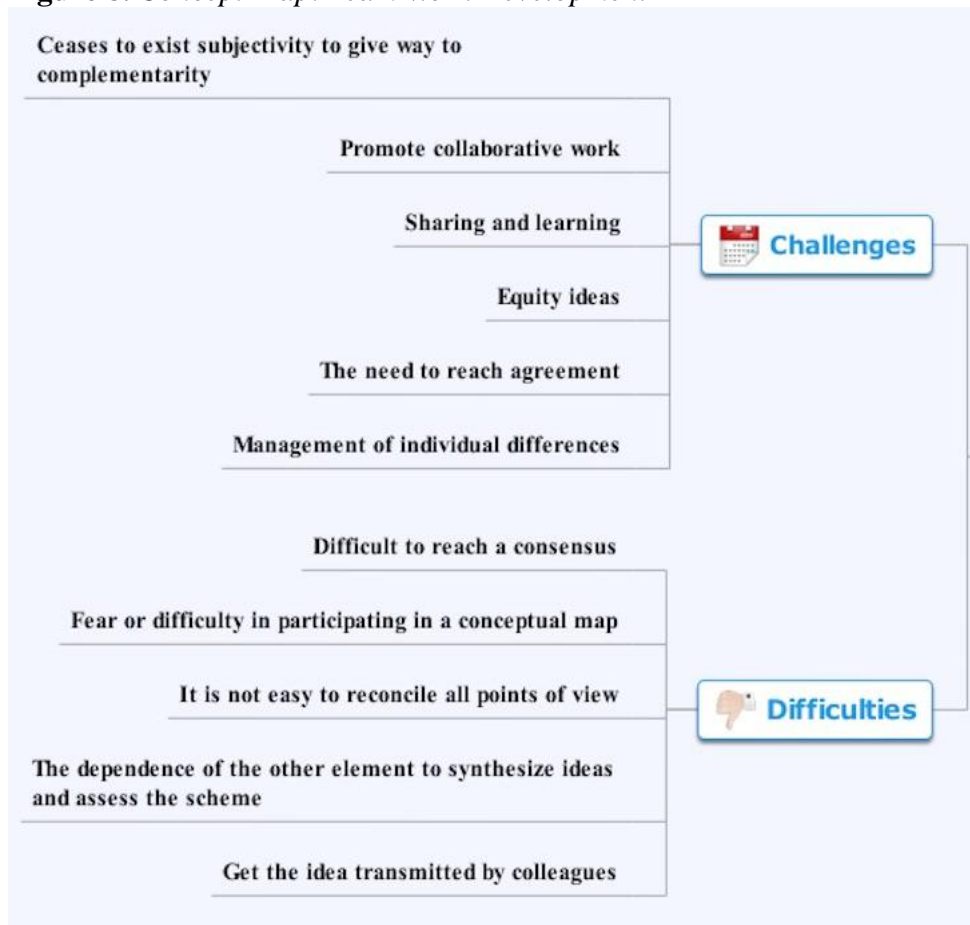
**Figure 7.** *Concept Map: Individual Development*



The difficulties experienced by students at individual level in the concept maps preparation can be grouped into two categories. The first one concerns the instrumental character issues. That is, the difficulties connected with aspects related to the choice of instruments, the use of the tool, etc. The second category of arguments is from a conceptual character, such as, what information am I going to select, how am I going to systematize ideas ...?

*Team Work Development!*

**Figure 8. Concept Map: Team Work Development**



Here too, the students point to two orders of reasons related to the construction team of concept maps. The first summarizes the challenges of working together and building a map in a collaborative way. The other relates to the difficulties students felt in developing a concept map in a collaborative work perspective.

Finally, we will address the overall assessment given by the students to this type of instrument.

Agreeing with the information found in the results, the majority of the students considered the use of conceptual maps to be very useful - *On a scale of 1-5 which is the classification that you would assign to this work tool...* (1 - Not Useful / 5 - Very useful). The average for global classification is 4.52.

**Table 3. Global Classification**

Scale (%)					Average (1-5)
1	2	3	4	5	
0	0	9.5	28.6	61.9	4.52

The answers ranged from 3 to 5, but the majority were given to the highest value 5 – Very useful.

## Conclusion

Preliminary results indicate a positive evaluation of concept maps, particularly in the construction, representation, and organization of knowledge. They help to simplify complex realities, promoting collaborative work and learning. However, its individual design and construction carries problems in identifying the key concepts and schematization of the ideas.

From a teamwork point of view, it requires management of individual differences and sets aside the subjectivity to give place the complementarity, and *promotes collaborative working, sharing, and, consequently, learning*. 61.9% of students rated this working tool as "very useful", as a general observation, concept maps were considered a tool that allows a better understanding and representation of the different theme contents. However, the construction of concept maps in group is a more complex process. This study, and its preliminary results, shows the potential of this work tool as a methodology, adopted by us, to promote not only individual learning but also collaborative work. Based on this evidence, we will adopt the same methodology in other subjects and with other groups of students, in order to reinforce or find other work methods. Our results agree with previous studies about the importance of using conceptual maps as a tool for individual and collaborative learning (Chiou, 2008; Kinchin; Hay & Adams, 2000; Hilbert & Renkl, 2008; Wheeler & Collins, 2003). These studies highlight student's satisfaction in the use of conceptual maps, leading them to better understand, integrate, and clarify the concepts, as well as develop their critical thinking.

The virtual space, by definition, allows new ways for students to interact with information, and therefore to develop new ways of learning. Teachers who work in this environment must help students while managing these situations. Students should know that it is more than just dominating a new knowledge representation instrument; it is a new learning culture. This assumes that professors have to do more than transmitting the information, promoting competences of searching, selecting, and interpreting the information available (Goulão, 2012).

## References

- Cañas, A. & Novak, J. 2008. Facilitating the adoption of concept mapping using CmapTools to enhance meaningful learning. In Okada, A, Buckingham Shum, S. J., Sherborne, T (eds). *Knowledge Cartography, Software Tools and Mapping Techniques*. Springer, London, 1-26

- Chiou, Chei-Chang 2008. The effect of concept mapping on students' learning achievements and interests. *Innovations in Education and Teaching International*, 45 (4), 375-387
- Christen, A.2008. The Way We Learn Now. *Learning-Circuits Archives*. Available in <https://www.td.org/Publications/Newsletters/Learning-Circuits/Learning-Circuits-Archives/2008/05/The-Way-We-Learn-Now>
- Goulão, M.F. 2015. *The E-Activities to Support the Process of Teaching and Learning in Online Context*. Athens: ATINER'S Conference Paper Series, No: EDU2015-1625.
- Goulão, M. F. 2012. Ensinar (e aprender) em ambientes virtuais de aprendizagem: Alterações e continuidades na(s) prática(s) docente(s). In Moreira, J. & Monteiro, A. *Ensinar e aprender online com tecnologias digitais*. Porto Editora, Porto,15-30
- Goulão, Mª F. 2009. Metacognition, Learning Styles and Distance Education. In Subhi-Yamin,T.. *Excellence in Education 2008: Future Minds and Creativity*. Proceedings of the Annual Conference of the International Centre for Innovation in Education (pp.224 – 232). ICIE: Ulm- Germany
- Goulão, M.F. & Henriques, S. 2015. Ensinar e aprender em ambientes virtuais de aprendizagem. In Moreira,J.Barros,D. & Monteiro (org.), *Inovação e Formação em Rede na Sociedade Digital: Ambientes Virtuais, Tecnologias e Serious Games*. Withebooks editors. Santo Tirso, 21-36.
- Hilbert, T. & Renkl, A. 2008. Concept mapping as a follow-up strategy to learning from texts: what characterizes good and poor mappers? *Instructional Science*, 36 (1), 53-73
- Illeris, K. 2008. *How we learn: Learning and non learning in school and beyond*. Routledge, London
- Jarvis, P. 2010. *Adult education and lifelong learning: Theory and practice*. Routledge, London
- Kinchin, I.; Hay, D. & Adams,A. 2000. How a qualitative approach to concept map analysis can be used to aid learning by illustrating patterns of conceptual development. *Educational Research*, 42 (1), 43-57
- Mason & Rennie,2008. *E-learning and Social Networking Handbook – Resources for Higher Education*. Routledge, London
- Novak, J. 2000. *Aprender, criar e utilizar o conhecimento: Mapas conceituais como ferramentas de facilitação nas escolas e empresas*. Plátano Edições Técnicas, Lisboa
- Pachler, N. & Daly, C. 2011. *Key Issues in e-learning:Research and Practice*. British Library, London
- Serra, M. J., & Metcalfe, J. 2009. Effective implementation of metacognition. In D. J. Hacker, J. Dunlosky, & A. C. Graesser (Eds.), *Handbook of metacognition in education*. Routledge, New York, 278-298
- Smith BL, MacGregor JT.1992. What is collaborative learning? In: Goodsell AS, Maher MR, Tinto V (Eds.), *Collaborative Learning: A Sourcebook for Higher Education*. National Center on Postsecondary Teaching, Learning, and Assessment at Pennsylvania State University.

- Wheeler,L. & Collins,S. 2003. The influence of concept mapping on critical thinking in baccalaureate nursing students. *Journal of Professional Nursing*, 19 (6), 339-346
- Winne,P.H. & Nesbit,J.C.2009. Supporting Self-Regulated Learning with Cognitive Tools. In Hacker, D., Dunlosky,J. & Graesser, A. (Eds). *Handbook of Metacognition in Education*. Routledge, New York, 259-277