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A study of the meaningful learning by business management students

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In the search to improve the quality of education at the university level, the use of concept mapping is becoming an important instructional technique for enhancing the teaching-learning process. This educational tool is based on cognitive theories by making a distinction between learning by rote (memorizing) and learning by meaning, where learners set up their process of acquisition of new concepts and enhance their cognitive structure for creative problem solving. The potential of concept mapping to improve education can be considered: (1) as a planned learning strategy, (2) as an instructional strategy in the classroom, (3) as a strategy for planning students' curriculum, and (4) as a means of assessing students' understanding of concepts. The purpose of this article is to evaluate this learning tool for the assessment of business management degree students. Also, the article includes conclusion, limitations and possibilities for future research in the final section.

Key words: Concept mapping, meaningful learning, innovative education, assessment of learning, education quality.

INTRODUCTION

The concept mapping technique was originally created, developed and implemented in the 1970s by Professor Joseph Novak (2010) at Cornell University as a graphic means of representing the knowledge of emerging science concepts among students. Since then it has been used to increase meaningful learning in students (mainly in the sciences) and for representing the knowledge experience of individuals and teams in education, government and business fields (Novak, 1998). Concept maps have their roots in the cognitive theory of Ausubel (1963) that was part of the constructivism movement in educational psychology (Novak and Cañas, 2011). In particular, this branch of science holds that learners

actively construct and assimilate new concepts through prior knowledge (Ausubel et al., 1978).

Accordingly, meaningful learning theory is based on the premise that the most important factor influencing learning is what the learner already knows (Novak, 1998). In that sense, this conceptual approach is interested in:

1. How students learn large amounts of meaningful concepts from verbal/textual presentations in planned activities.
2. The representational, super-ordinate and combinatorial processes that occur during the reception and absorption of information.
3. The processes used when new information is acquired by linking with the knowledge embedded in the learner's own cognitive structure.
4. The primary process in learning where new material is

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Table 1. Significance-based learning vs. memory-based learning.

Learning	Significance-based	Memory-based
Based on	Creative production	Memory repetition
Main characteristics	Incorporating non-arbitrary, substantive and non-literal of new knowledge	Incorporation of new knowledge in a non-substantive, arbitrary and verbatim process.
	Effort to relate new knowledge to concepts of higher order	No effort to integrate new knowledge with existing concepts
	Related learning experiences, events or objects.	Unrelated learning experiences or events.
	Affective commitment for linking the new knowledge and concepts with the prior concepts owned by learners.	No affective commitment to relate new knowledge with prior learning.

Source: Adapted from Novak (1998).

related to relevant ideas in the existing cognitive structure on a non-verbatim basis (that is, previous knowledge).

Novak (1998) used Ausubel's theory to explain that meaningful learning involves the assimilation of new concepts and propositions into existing cognitive structures. This process is considered as a type of learning process based on creative output and not on mechanical repetition or memorizing (Table 1).

Thus, on the one hand, in order to develop meaningful learning, students need to intentionally relate non-arbitrary and substantive (not literally) new concepts with other concepts they already know (Novak and Gowin, 1996). This effort allows students to learn based on experiences, events or objects. This learning process also creates an emotional commitment that makes it easier to relate new knowledge with previously learned knowledge. On the other hand, rote learning is focused on incorporating knowledge in a mechanical and repetitive way. Therefore, it does not integrate this new knowledge with existing knowledge or related experiences or events or develop a certain emotional commitment in the process. Rote learning simply incorporates knowledge by memorizing (Gonzalez, 2008).

Meaningful learning is contextualized by existing social interactions among subjects through the creation of learning environments that cause cognitive conflicts and a conceptual change in the learner (Novak, 1998). In addition, most learning takes place in a collaborative environment. This allows the subject of learning to benefit from dialogue with peers and instructors (Ballester, 2002). Also, this is reinforced by the consequences of a positive affective domain derived from new knowledge (Gonzalez, 2008).

Among the potential uses of concept mapping for the improvement of learning and teaching in classrooms, Novak (1990) outlined that the powerful technique of concept mapping could improve education in four different categories: (1) as a planned learning strategy, (2) as an instructional strategy, (3) as a strategy for planning curriculum, and (4) as a means of assessing students' understanding of science concepts.

The aim of this article is to use concept mapping for the assessment of learning of college students in a Business Administration program. This assessment is a natural consequence of the planned learning process that is developed in the classroom and is mainly oriented to make a change in the cognitive structure of students (which, of course, in turn, will have been formed through meaningful learning) modified by new acquired knowledge (Novak and Gowin, 1996).

The second section of the article discusses the conceptual basis of concept mapping in order to introduce the materials and methods used in the assessment of the meaningful learning by business management students. The third section presents the results of the empirical study. The last section interprets the main findings and conclusions obtained, together with the limitations and possibilities for future research derived from this study.

MATERIALS AND METHODS

Conceptual basis of the research

To understand concept mapping and its role in the teaching-learning process, it is crucial to make a clear distinction between rote learning and meaningful learning (Novak and Cañas, 2011). The former is based on students' memorization of information without relating it to their prior knowledge or their current experiences, whereas meaningful learning occurs when students internalize concepts by linking them to previously assimilated information (Novak, 1990). This distinction also calls for distinguishing between extrinsic and intrinsic motivation of students. Intrinsic motivation stems from the feeling of learning new things and the power that comes with significant learning (mainly the satisfaction of learning), whereas extrinsic motivation is based solely on certain outcomes and tangible rewards (e.g., good qualifications) (Gonzalez, 2008).

Therefore, the use of concept mapping in schools, universities or corporations is also related to the planning of the learning process in order to deal with the motivation related variables that determine the depth and quality of learning activities (McClure et al., 1999; Ballester, 2002), such as:

1. The openness of the process, through individual activities or in teams, and in a non-strictly planned way, makes the students enhance their learning.

2. Extrinsic motivation (results and rewards), intrinsic (learning "per se") and adult approval (the positive reinforcement motivation of the instructor) promote meaningful learning.
3. It must be a contextualized learning environment that makes sense and enhances the ability to transfer concepts and knowledge in students.
4. The creativity and ability of students to create a combination, partnership and transformation of known elements can lead to new results through the combination and trial-error processes.
5. The concept mapping is a technique for developing mental models of learning, where concepts are related in a hierarchical structure, which are intended to represent meaningful relationships between concepts in the form of propositions with real meaning.
6. The adaptation of students' curriculum that includes the necessary changes to make in the core of the learning process to adapt it to new situations.

Consequently, to achieve meaningful learning it is necessary to focus the work in each of the above variables to optimize in the process (since it is impossible to perform them all at once). Ballester (2002) concludes that for this process to be effective, it is necessary to consider two factors: the first one consists of the planning and application of the first variables: the open job, motivation, environment and creativity. This first factor can improve the classroom learning environment, reducing student's unrest and also easing the difficulties of teaching. A second factor is where we focus our innovative educational experience. Therefore, concept mapping is an educational tool that is applied for the assessment of their significance-based learning. Therefore, the first group of variables would be the necessary conditions for setting up the experience, while the second group would be used for the assessment of the acquired meaningful learning.

Accordingly, as Novak and Cañas (2011) argue, the use of this learning technique for assessment of learning is not intended to replace any of the activities planned in the classroom (lectures, exercises, case studies, problem resolution, critical thinking, numerical practices, etc.). Its main role is to complement the other activities in the sense that concept mapping reflects the view of learning from a constructivist perspective to generate knowledge that is the result of durable and active learning (Novak, 1998). Furthermore, the elimination of basic or essential activities (and their assessment) in the subject planning could limit the intended meaningful learning (Castillo, 2001). The active process in which concept maps are developed is based in activities for groups of students that have to interact and play with the concepts as mainly content to embed. Consequently, the activities exceed simple memorization, because it is more important for the student to find the meaning of relationships between concepts (Gonzalez, 2008).

As was introduced previously, concept mappings are widely used in the assessment of the learning process in order to (Novak and Cañas, 2006):

1. Summarize key concepts, their relationships and hierarchies from documents and source materials.
2. Create new knowledge: e.g., transforming tacit knowledge into an organizational resource by mapping team knowledge.
3. Facilitate collaborative knowledge modeling and the transfer of expert knowledge.
4. Facilitate the creation of a shared vision and shared understanding within a team or group.
5. Develop instructional design of an initial conceptual frame for subsequent information and learning.
6. Develop training activities through the training context and its relationship to training goals.
7. Increase meaningful learning.
8. Communicate complex ideas and arguments.
9. Detail the entire structure of an idea, train of thought, or line of argument (with the specific goal of exposing faults, errors, or gaps

in one's own reasoning) for the scrutiny and assessment of others.

10. Assess learners' understanding of learning objectives, concepts, and the relationship among those concepts.

Therefore, our objective for using maps in the assessment of learning is twofold: first the teacher starts planning and building the body of knowledge with students and exploring their available prior knowledge. Second, the students need to organize, interrelate and set up knowledge of content studied, knowing that this activity will have an intrinsic motivation and an extrinsic reward in their final qualification. So, as Novak and Gowin (1996) argue, this assessment can be used to detect previous wrong ideas and misconceptions at the beginning of a learning unit or through the presentation of concepts and the addition of new information and knowledge to the process. Therefore, evaluation and assessment of the meaningful learning acquired through new concepts can help to identify or diagnose misunderstanding among students (Novak and Cañas, 2011).

In summary, the main benefits for assessment of learning among students are framed within the educational environment, where concept maps are planned as an active process in which instructors evaluate their learning of concepts over time. This planning determines that in order to promote creative learning instructors must set up an arbitrary incorporation of new concepts in the course taken, linking the conceptual meaning of new concepts to the interiorized concepts that students have previously acquired. In this manner and within the university context, to assess student progress in their learning activities, it would be necessary to measure the evolution obtained in the student's mark for this learning activity at various points in time (Costamagna, 2001). Consequently, the use of concept maps over a course taken may be justified if at the end of the course the student can build a concept map showing a valid number of relations according to the knowledge and concepts acquired.

Empirical study

For the empirical test of the assessment of learning among Business Management students, a study was done with a population of 74 students during the academic year 2009/2010 in the Business Administration program in the Social Sciences Faculty at UCLM (University of Castilla-La Mancha, Spain). The subject analyzed was Essentials of Business Management, which is placed in the first year and in the second semester (February to May). The course is taught with ECTS (European Credit Transfer System) methodology, where the final qualification of students is the result of a final test (60% of the mark) and other learning activities (40%). Concept mapping accounted for 10% of the final (and therefore 25% of the learning activities). The maps were performed in groups of three and four students, for a total of 16 groups. The maps planned had as their main aim to show what students have learned in the course taken and to enhance understanding of new basic concepts for their future management of business tasks.

The introduction of concept mapping was innovative for instructors and students. Instructors received training for 20 h in the two weeks prior to the start of the course. There was also an introductory and training workshop with students, who were introduced to the tool through three sessions of two hours in order to explain to students how to construct concept maps. Most of the didactic material used was obtained on the specialized Spanish website (<http://www.aprendizajesignificativo.com>). In this website can be found high quality teaching material supported by the Ministry of Education, Culture and Sports of the Canary Islands region. Several e-books, PowerPoint slides, training manuals and free software needed to learn can be downloaded from the site and the appropriate use of maps for learning purposes (at all levels from school to university and postgraduate or corporations) is discussed.

Table 2. Means in qualifications and t-student of the sample t.

	Average mark	in the average mark	T-test for two related samples	
			T statistics	Sig.
Sample in first map	5.67	0.71	2.776	0.014*
Sample in second map	6.37			

* Significant for $p < 0.05$.

its use, how to build maps, what aspects of the map were more important and finally how it would be assessed. Furthermore, the students were provided the Moodle platform of the Faculty with some extra examples, PowerPoint slides, background material and additional literature for the realization of concept mapping.

The steps used to construct the maps were adapted from the method proposed by Novak and Gowin (1998), which consisted of seven sequential steps:

1. First step: After reading a text on a specific topic, the student must select the concepts and make a list in order to be ready to work with them. Concepts can never be repeated more than once in the same map.
2. Second step: Group related concepts by meaning.
3. Third step: Rank and sort from the more general concepts to the more particular and specific meanings.
4. Fourth step: Represent and put the concepts in the diagram.
5. Fifth step: Connect and relate the different concepts in order to check whether students understand a subject correctly. In this step, students also have to connect the concepts using linking words to create a proper sentence. In the map, the direction of the arrow indicates the meaning of a sentence.
6. Sixth step: Check the map and see if it is rightly or wrongly constructed. In the event it is incorrect, the student must correct (concepts of linking words) by adding, removing, changing the position, and so on.
7. Seventh step: Reflect on the map structure in order to determine if the different sections can be united. Also, this is time to look for hidden relationships not seen before that can provide new knowledge on the subject.

Once the students were introduced to concept mapping methods and divided into groups, they made two maps at two different times. The first one was done in the middle of the term, during the eighth week (of 15 weeks), while the second one was done at the end of the term. The first map was made after completion of the didactic unit number 6 (of 11) and after performing other learning activities (numerical exercises and case studies). Considering that the business management students had only completed one semester at university, the first of the seven steps (Selection of concepts) was omitted. Most of the first 15 concepts selected by the instructors for the first map highlighted some basic concepts that the students already knew (e.g., employer, firm or benefit) and added some more specific concepts they had learned during the first teaching of the subject units (e.g., competitive strategy, business cluster or transaction costs). Likewise, using the same methodology, 20 concepts were selected for the second map.

There is no universal method of evaluating work (Brüssow and Wilkinson, 2007), and an adaptation of the evaluation criteria proposed and validated in previous studies was performed. So, in our opinion it does assess key aspects like explicit direct links, relationships, hierarchy, correction and knowledge embedded (Costamagna, 2001). Thus, instructors scored (in % of the mark) the following aspects of the concept maps built:

1. Identification of immediate relations (direct links) (30%)

2. Identification of remote or indirect links (20%)
3. Use other items (not included in the material provided by the instructor) (20%)
4. Hierarchical structure of the map (order and grouping of concepts) (15%)
5. Choice of five basic relationships that define the core of the subject (15%)

RESULTS

After the correction of the two concept maps, and using the marks obtained for each of the groups, a correlation analysis was performed in order to check if the scores of each group for the first map (at middle term) were related to the marks at the end of the term. It was found that the mean scores on the two maps were positively and significantly correlated ($r = 0.688$, $P < 0.05$). After that, a t-student test of mean differences (Table 2) was performed for two related samples. It was found that on the second map, students' marks were significantly higher than those obtained on the first map. Therefore, we accept the working hypothesis based on the assumption that due to continuous and active learning, at the end of the course the students have achieved more knowledge and learning about the concepts of the subject, which is reflected in obtaining a better score (mean increase of valuation of 0.71).

Due to the experimental nature of this research study and in order to determine the validity of these results, we use historical marks from students in previous years before the concept mapping technique was introduced as learning activity and students were required to take a multiple choice evaluation test based on memorizing the concepts explained by the instructor during the semester. They took two evaluation tests, one halfway through the semester and one at the end. We could find no significant difference between the marks obtained on the two tests. In Figure 1 it is shown an example of one of the concept maps constructed by a group of students.

DISCUSSION

In conclusion, it can be said that concept mapping is considered a powerful tool to enhance meaningful learning and an innovative way to assess the acquisition of knowledge in students. This first experience shows concept mapping as a complement to traditional

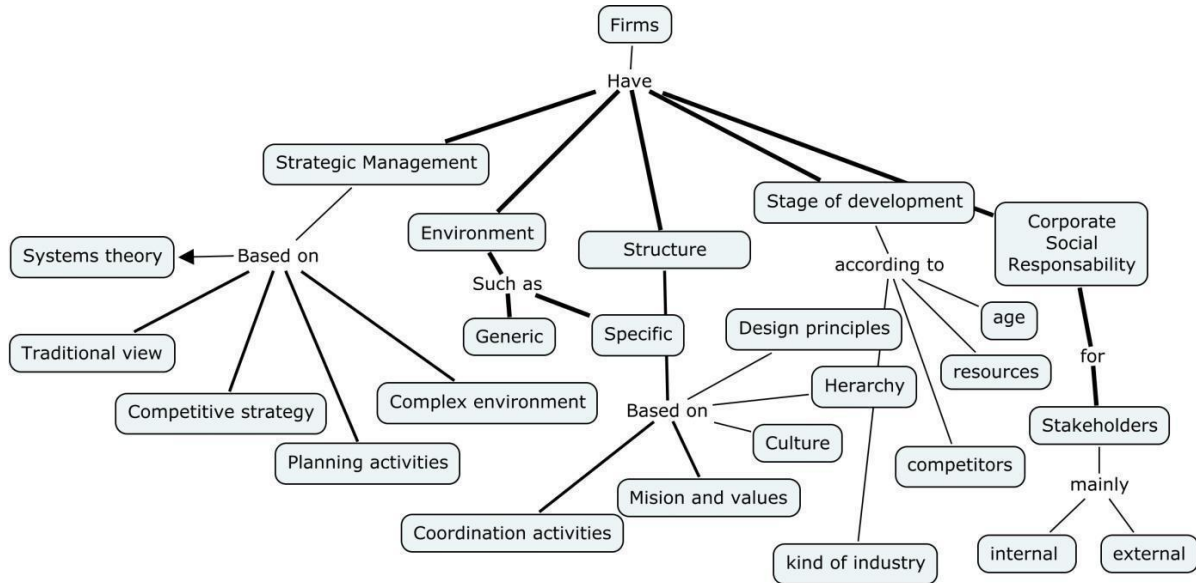


Figure 1. Concept maps.

evaluation systems, allowing teachers to determine whether the performance achieved by the students comes from high levels of conceptual understanding. In this particular experience, it was found that a significant increase in their student learning is not a result of memorizing the meaning of new concepts. However, the experimental character of concept mapping in the business management curriculum (To our knowledge, our research is pioneering) must be emphasized. Also, it must be stressed that this innovative educational activity is based on the planning of the introduction of new concepts to students in order to improve their understanding, synthesis process and organization of the concepts to be learned during the course taken. Consequently, this activity provides the instructors with valuable feedback for the next instructional planning.

Also, the subject Essentials of Business Management is planned for the second quarter and a first-year Business Administration degree and uses the concept mapping tool to enhance the active learning process of students who are not familiar with the technique. In that sense, we believe that its realization as a group task allows student interaction and creates a favorable environment in the process of assimilation of new concepts. Therefore, it also has improved the students' establishments of links with concepts previously obtained before entering college and with others they have acquired in other related subjects (i.e., Essentials of Finances).

However, it is necessary to point out that this experience has some limitations. The first is the experimental nature of our research. We cannot use a control group of students who were not doing concept maps and to compare the significant increase achieved in the marks.

The second limitation is related with the rating of the marks as the sum of five criteria and not from the point of view of the increase in each one of the criteria (direct links, indirect, new concepts, hierarchy and key relationships that define the core of the subject). Third, with the realization of only two maps, we have results indicating the increase of students' learning in only two moments of time; it more maps and longer period of time are needed to measure the real effect of this tool on the learning results of students.

In terms of future research, this paper is a first, experimental attempt to study the use innovative tools for assessment student learning. Therefore, a more complex model is needed to identify the key factors that can determine the knowledge acquisition process of students, which is mainly an individual process that can be influenced by other educational variables. Finally, it would be interesting to do more research in concept mapping as a planned learning strategy, as a tool for brainstorming, as an instructional strategy, and as a strategy for planning students' curriculum.

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