

Conceptual Cartography as a Didactic Strategy: Reconstruction of the Methodological Horizon

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Abstract:

Background: In the last decade, conceptual cartography has aroused interest in the academic and educational field, which is why the study was carried out with the purpose of reconstructing the methodological horizon of conceptual cartography through the application of philosophical hermeneutics to facilitate understanding and use in teaching practice as a learning strategy.

Materials and Methods: A qualitative and documentary study was carried out, from the hermeneutic interpretive approach based on the principles of Gadamerian hermeneutics, focusing attention on the pedagogical proposal of Sergio Tobón. The study was carried out in 4 stages: characterization of conceptual cartography as a hermeneutic situation, construction of the horizon of meaning, deconstructive or problematizing, and constructive or fusion of horizons.

Results: Conceptual cartography is based on complex thought, socioformation, conceptual mindfacts and concept maps; the characteristics attributed to conceptual cartography are multidimensionality, integrality and sequentiality. It presents a binary composition that integrates a graphic map and the corresponding conceptual argumentation; in which 4 "key elements" and 8 axes are integrated. The "key elements" are: conceptual analysis, graphic synthesis, establishment of relationships between components and axes, textual or oral explanation of each axis. The axes are: exemplification, notion, categorization, characterization, differentiation, division or applications, linking and methodology.

Conclusion: Conceptual cartography is a learning strategy centered on the student, the context and the management of scientific knowledge, to build and communicate declarative, methodological, procedural and/or axiological knowledge, through deepening the study of a concept, theory or Relevant methodology indicated in the cognitive competencies declared in the educational program.

Key Word: Conceptual cartography; Complex thought; Socioformation; Learning strategy; Knowledge management.

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I. Introduction

Education in general, and higher education in particular, continues to search for meaning in a world that every day becomes socially, politically, ideologically and economically polarized; search process that, in addition to reflecting the complexity of the educational phenomenon^[1], makes it possible to open paths to the renewal of the human being through redimensioning to reinvent education in the context of a globalized world, the knowledge society and in post-pandemic. In summary, as expressed by Morin and Delgado "reinventing education means linking citizenship with the transformation of politics and the reforms of thought and teaching, disseminating in one the reforms of thought, teaching, politics and life"^[2].

From different epistemological positions^[3], criticisms are made towards training based on instructional models inspired by behavioral approaches^[4] to promote the use of models based on constructivist theories, which are ultimately directed towards the development of professional skills. However, the debate continues; either to rethink the scientific field and the application of pedagogy^[5] and didactics with teaching^[6], design didactic strategies for educational intervention^[7], reconnect education with all the dimensions of the world of life in which it will unfold the student^[8,9].

However, it seems that the only concrete reality is that the student must be trained for life in society, where he exercises his citizenship and joins the hegemonic economic system of the country to carry out his life project and participate in the production of goods and services. In this scenario, it must be recognized that the student has the experience of a lived academic and school life, is located in his world of life, interacts with his environment and assumes the challenge of functioning in his physical-biological and socio-cultural context, which entails the responsibility of the praxis of life, that is, the need to transform the material, social, cultural and spiritual conditions that are affecting its integral bio-psycho-socio-spiritual development around the man-society-world axis. Following this line of reflection, education assumes the challenge of focusing training in

terms of learning to be, learning to know, learning to do and learning to live together, which implies reinventing, reorienting, rebuilding and strengthening the teaching and learning processes; but recovering the characteristics of the student derived from his school experience and his academic life^[9]. Following this aspiration, multiple pedagogical approaches and student-centered educational models have been implemented. Among this variety, evidence-based education stands out, understood as the pedagogical model that, in addition to resorting to the generation and communication of knowledge built through educational research, constitutes a tool that contributes to the well-founded and critical use of didactic strategies based on the triad practice-theory-reflexive practice^[10,11].

Evidence-based education is an approach that allows students to align their training with the requirements of the knowledge society. This implies that the educational process, as an educational intervention aimed at the integral development of the student, must start from its sociocultural context and the individual characteristics of the student. Essentially it answers the question: what are the characteristics of the students enrolled in the subject to define the teaching strategies and design the learning activities? Thus, Alegre and Kwan^[12] consider that evidence-based education is a methodological strategy that offers the possibility of using teaching and learning strategies that allow addressing the differences that characterize students and are associated with learning style, which It implies promoting not only oral and written language, but also visual language.

When exploring the different strategies that are being reported in the literature in the first decade of the 21st century, the use of an active, contextual, critical, heuristic methodology of a historical-cultural nature stands out, which contributes to managing knowledge, which systematizes and structures the previous knowledge with which they are acquired, in addition to resorting to the use of the image to transmit the information, which allows the student to reconstruct the declarative, procedural and axiological knowledge through the development of the learning contents from their lived experiential context, as well as comprehensively evaluate the academic competencies defined in the subjects of the educational programs that the student must take. This strategy is conceptual cartography.

The methodology for its elaboration and application based on complex thought, was proposed by Sergio Tobón in 2004 and included in the course "Didactic Strategies to form competences" in the context of the IV Virtual International Congress of Education held from February 9 to 29, 2004^[13]. In the last decade, conceptual cartography has aroused interest in the academic and educational field, which is why it is currently being applied as a didactic tool at all educational levels and also as a methodological tool in educational research. Based on the above, the study reported in this article was carried out, with the purpose of reconstructing the methodological horizon of conceptual cartography through the application of philosophical hermeneutics to facilitate understanding and use in teaching practice as a learning strategy.

II. Material and Methods

A qualitative and documentary study was carried out, from the hermeneutic interpretive approach based on the principles of Gadamerian hermeneutics^[14]. Hermeneutics allowed the semiotic analysis of the content that underlies Sergio Tobón's pedagogical proposal and in texts related to conceptual cartography, to make evident the meaning of the analytical categories within the context of higher education and complex thought. The analysis categories and reflection-generating questions that were developed in the study were the following: concept, characteristics, foundations, components and application in the school classroom (Table 1).

Table 1: Categories of analysis and questions that generate reflection.

Analysis Category	Thought-provoking questions
Conceptual cartography concept	What is the concept of conceptual cartography proposed by Sergio Tobón?
Fundamentals of Conceptual Cartography	What are the epistemological foundations of conceptual cartography?
	What are the pedagogical foundations of conceptual cartography?
	What are the didactic foundations of conceptual cartography?
Characteristics of conceptual cartography	How are the characteristics of conceptual cartography made possible from complex thought?
Conceptual cartography components	What are the components of conceptual cartography?
Application of conceptual cartography in the classroom	What are the recommendations for applying conceptual cartography in the classroom?

Source: self made.

The study was developed in 4 stages. In stage 1, the characterization of the hermeneutical situation was carried out, understood as the relationship between the subject that interprets the text and its hermeneutical horizon, a founding relationship from which it is possible to understand the meaning of the texts included in the study^[15,16]. The research technique used during the stage was documentary research, taking into account the characteristics of the philosophical research method^[17]; Therefore, we proceeded to search, select, organize and

analyze primary and secondary sources related to conceptual cartography using the Google Scholar tool, Redalyc, Scielo and Latindex. For the search, the term "conceptual cartography" and "Sergio Tobón" were used. Texts published in the period 2000 to 2022 were included. 14 books by Sergio Tobón and 7 complementary books were selected that made it possible to contextualize the proposal for the elaboration of conceptual cartography (Table 2).

Table 2: Number of texts included for the development of the study.

Text	Related to the topic	Complementary
Book	14	7
Chapter of the book	1	1
Theoretical research articles	4	4
Empirical research articles	5	11
Didactic manuals	2	0

Source: self made.

In stage 2, the horizon of meaning was characterized, where the actual historical awareness of the subject's hermeneutic situation in its historical context is exposed, which is determined by previous experience, prejudices and limitations in understanding ^[14]; that is, the understanding horizon was elaborated that made possible the interpretation of the categories of analysis from the characterization of conceptual cartography as a hermeneutic situation.

In stage 3 (deconstruction stage) the meaning of the problem posed to analyze the conceptual cartography was revealed, placing it in the world of life, for which two phases were developed: analytical and comprehensive. In the analytical phase, answers were given to the guiding questions of each of the analysis categories, preparing thematic area sheets and problem area sheets to identify and systematize the elements that structure the analytical categories. In the comprehensive phase, conceptual contents were identified through the theoretical confrontation of concepts and topics delimited in the categories, developing schemes, constructing relevant questions and synoptic tables; Through recovery matrices, alternative response options to the questions raised were analyzed.

In stage 4 (constructive stage or fusion of horizons) the conceptual and thematic components of the categories of analysis were articulated, making it possible to understand the original meaning of conceptual cartography and its relationship with the world of life, for which two phases: reconstructive and critical. In the reconstructive phase, the conceptual contents forgotten by the methodological abstractions were thematized and recovered, facilitating the merging of the horizons that lead to the hermeneutic circle of understanding-interpretation-application. In the critical phase, the methodological horizon of conceptual cartography was reconstructed and the link between the categories of analysis was opened, making it possible to expose the consequences of its application in the orientation of new areas of hermeneutical research.

III. Result and Discussion

Tobón defines conceptual cartography as a "concept construction and communication strategy based on complex thought, through verbal, non-verbal and spatial aspects"^[13,18]. This definition implies: recognizing that it is a learning strategy; it is a process of construction of concepts that allows the development of cognitive competences of declarative knowledge; communication skills articulating verbal, non-verbal and spatial elements; It is a strategy that helps the student analyze reality from the whole/part/whole relationship, associating prior knowledge with new knowledge and specifying its analysis in the surrounding context.

As the publication of studies where conceptual mapping was used as a methodology progressed, it was possible to clarify and specify the concept of conceptual mapping. In this conceptual development, studies show that it is still considered as a learning-oriented strategy, but focused on the student's context, the management of documentary research and scientific knowledge. It is explicitly stated that it promotes in-depth analysis of the prevailing scientific knowledge of a concept, theory or methodology, which are indicated as essential or relevant in the competencies declared in the educational program. This analysis leads to the construction of different knowledge (know, do, be) through the systematization of information accessible to the student. In this way, it develops the ability to build the missing knowledge and meet the learning needs generated during the study and analysis of the information consulted. It also contributes to the understanding of the concept under study and the ability to communicate it clearly in the academic community. At the end of the process, learning products are obtained that make it possible to evaluate the level of appropriation made by the student^[19,20].

Fundamentals of Conceptual Cartography.

Conceptual cartography, as Tobón points out^[13], is based on complex thinking, socioformation, conceptual mindsets, and concept maps (Figure 1).

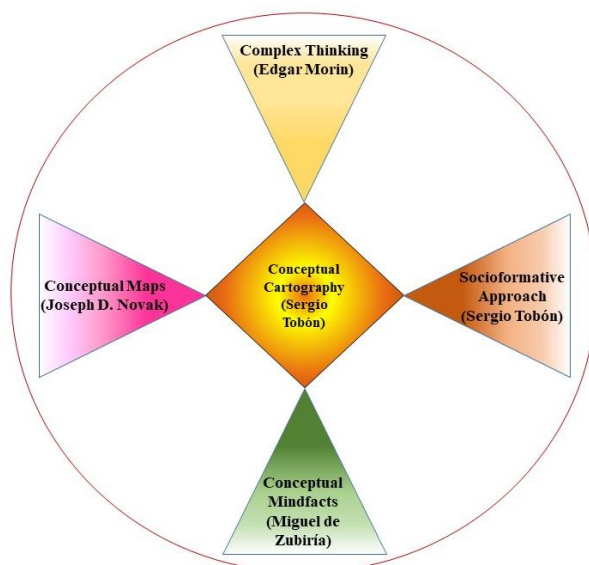


Figure 1. Schematic representation of the foundations of Conceptual Cartography.

The philosophical position of complex thought elaborated by Edgar Morín^[21] allows us to approach reality through the structuring of elements that allow us to analyze the whole from the part but without separating it from the totality that it is; Thus, it supports the possibility of linking and associating elements that are constituting reality understood as a complex phenomenon from the student's context. As González Moena points out, it is a thought "that integrates uncertainty and is capable of reconnecting, contextualizing, globalizing, but, at the same time, recognizing the singular and the concrete"^[22]. For the development of the cognitive operation of complex thought, Morin resorts to three principles: the dialogic principle, the principle of organizational recursion and the hologrammatic principle. The applications of these principles in the field of education to promote the construction of multidimensional knowledge, Sergio Tobón identified the following complex thinking abilities: metacognitive ability, dialogic ability, metanoia ability, hologram ability, and self-organization ability^[23]. Thus, both the principles of Morin's complex thought, as well as the skills enunciated by Tobón, contribute to founding the characteristics and elements that make up conceptual cartography as a concept construction methodology.

The pedagogical approach of socioformation proposed by Sergio Tobón in 2002^[24] was a consequence of the development and application of complex thinking in the field of education to fully train the student, with the purpose of promoting the development of the skills required to function in the context of the knowledge society and the dynamics of inter and trans discipline; which implies the development of the human talent management capacity in the student^[19]. In this line of reflection, socioformation is focused on the "development and management of people's talent, prioritizing the consolidation of their ethical life project, collaboration, entrepreneurship and the necessary knowledge for local and global problems, ensuring the strengthening of the social fabric and sustainable social development"^[25]. The characteristics of the socioformative approach enunciated by Tobón are: life project, entrepreneurship, management, co-creation of knowledge, collaborative work and metacognition^[26,27].

The conceptual mindfacts, a tool proposed and developed by Miguel de Zubiría Samper^[28] between 1995 and 1997, is a graphic organizer that consists of a hierarchical diagram of a cognitive type, which organizes knowledge by preserving fundamental ideas and discarding secondary ideas, for which organizes the propositions and preserves the concepts thus stored. It is structured by four conceptual intellectual operations in the construction of supraordinary propositions, exclusions, isoordinates and infraordinates^[29]. The supraordinary propositions refer to the most important characteristics of the concept, which is why it completely contains other propositions^[28,29]. Exclusions distinguish propositions that are mutually opposed or mutually exclusive, because the existence of a link between two classes of adjacent propositions is denied^[28,29]. Isoordinate propositions state partial correspondence with operations or links between adjacent propositions, which makes it possible to highlight relationships and links to link ideas together that give meaning to the structuring of propositions that precede concepts^[28,29]. The infraordinate propositions include several subclasses or derivations of a class,

dividing the propositions by image according to the following evolutionary sequence: pre-positions, notions, propositions, concepts, pre-categories and categories^[28,29].

The concept maps proposed by Joseph D. Novak in 1972^[30], are a strategy for significant learning that makes it possible to reorganize the knowledge that the student is acquiring through conceptual schemes, which is why it is aimed at instrumentalizing Ausubel's theory of significant learning from the approach to the constructivist position held by Novak^[31]. Thus, concept maps are "an educational instrument or scheme that allows the elaboration of a representation of significant and hierarchical relationships between new concepts, with general abstractions already acquired previously, emphasizing the cross-relationships between groups of concepts, globalizing the set of relationships in a wide mental construction in the form of propositions"^[32]. In its development, the central element is the "concept", understood as the word used to designate the image of an object, event or qualities that occurs in the mind of the student; and that it will be significantly related to another concept through linking words, giving meaning to the significant relationship in the construction of propositions.

Characteristics of conceptual cartography.

Conceptual cartography enables the student to develop and/or strengthen cognitive skills based on the construction of declarative knowledge (knowledge), procedural and methodological knowledge (know how to do), and axiological knowledge (to be and live together). This knowledge is indicated in the competences declared in the educational programs, and help to configure three characteristics attributed to conceptual cartography: multidimensionality, integrality and sequentiality (Figure 2).

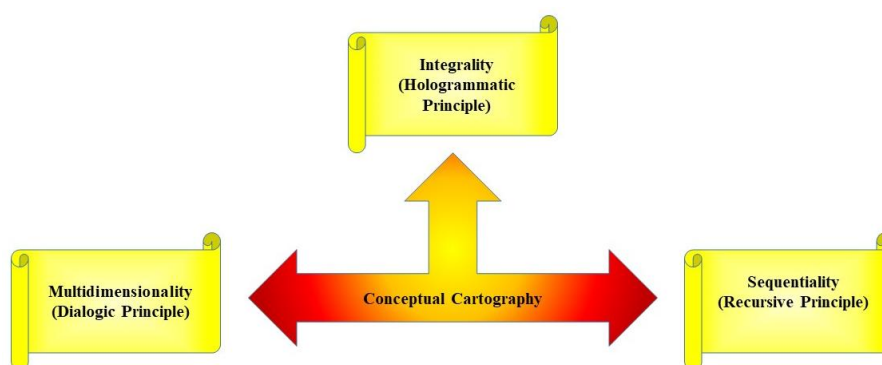


Figure 2. Schematic representation of the characteristics attributed to conceptual cartography.

The multidimensionality in the elaboration of the conceptual cartography refers to the identification, description and analysis of the dimensions or categories that are related to the concept under study. This characteristic is associated with the dialogic principle of complex thinking enunciated by Morin, which explains the complexity of reality through the union of the separated with the isolated (separated/isolated) and in the association of concepts that are shown as antagonistic; to make sense of the structuring of the levels of organization of the world that go from subatomic levels to the cosmos^[21]. In this process of accessing complex reality, the dialogic principle helps to explain the complex association (complementary/concurrent/antagonistic) of the elements that, together, are necessary for the existence, functioning, and development of the phenomena that manifest themselves in the reality. organization of the world of life^[22].

Integrality in conceptual cartography refers to the integration of the part and the whole; so that it is associated with the hologrammatic principle of complex thought enunciated by Morin^[21]. The process of construction of knowledge directed to the knowledge, understanding and transformation of the concrete reality of the student requires that the whole be included in a certain way in the part that participates in the constitution of the whole^[22]. In other words, when the student is building the concept that will allow him to access to know, understand and transform the world that surrounds him, he needs to understand that this concept is not isolated, detached from reality, on the contrary, he must keep in mind the relationships that the concept has with other elements of the reality of which it is a part. For example, when the medical student is building the concept of type 2 diabetes mellitus (the "whole"), she must know the mechanisms of homeostatic regulation of blood glucose (the parts are each of these mechanisms).

Sequentiality in conceptual cartography refers to the sequential, zigzag and cyclical operation with which it is built. It is directly related to the principle of recursion of complex thought enunciated by Morin^[21], since the process is cyclical, similar to a virtuous loop that produces/reproduces itself^[22].

Conceptual cartography components

Conceptual cartography is characterized by presenting a binary composition that integrates a graphic map and the corresponding conceptual argumentation, product of the review of primary and secondary bibliographic sources ^[13]; both components require the sequential integration of 4 “key elements” and 8 axes. The “key elements” have the function of methodologically guiding the activities carried out by the student to elaborate the conceptual cartography; these elements are: conceptual analysis, graphic synthesis, establishment of relationships between components and axes, textual or oral explanation of each axis; and they correspond to the complex relationship between the whole and the parts (elements-interrelationships-organization-whole) as shown in figure 3. The axes express the fundamental idea of the concept that is being analyzed, which is why they are incorporated into the graphic representation when constructing the conceptual cartography; these axes are: exemplification, notion, categorization, characterization, differentiation, division or applications, linking and methodology ^[20]. The binary map-argumentation composition allows the student to explain each one of the axes represented graphically, in such a way that he argues the scientific foundations of his knowledge in an original text and with reference to different authors; so that after identifying the characteristics of the part (the concept), she proceeds to reconnect the concept with the whole in which they are integrated.

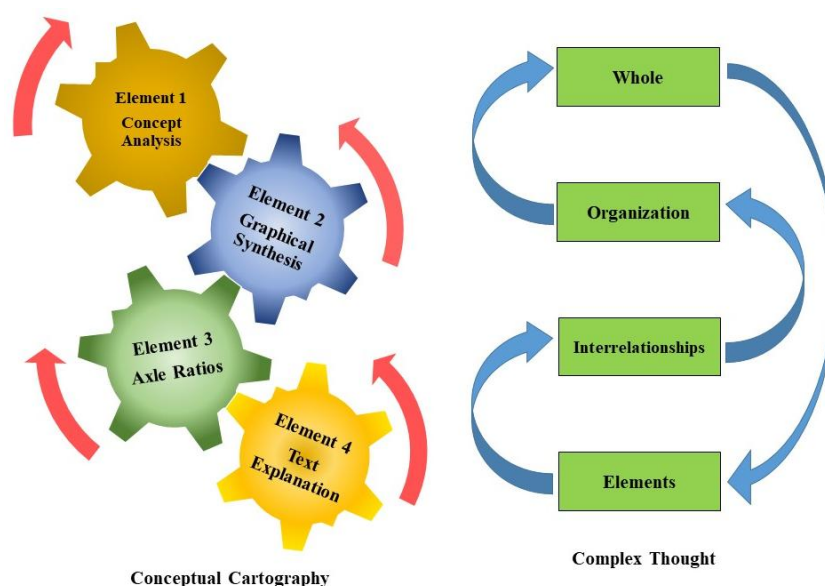


Figure 3. Schematic representation of the analogy between the components of conceptual cartography and the parts/whole relationship in complex thought.

The “element 1”, conceptual analysis, is oriented to the multidimensional analysis of the concept, theory or methodology, through the development of the axes that will allow the integration of the graph later ^[18]. It begins by recovering the previous knowledge that the student has regarding the characteristics of the concept that is analyzed. From this point, the student proceeds to search, identify, select and study different primary or secondary documentary sources, whose object of study is the concept under analysis; and sequentially defines the concept through the description of the aspects that characterize it.

In “element 2”, graphic synthesis, the concept, theory or methodology is placed in the center of the graphic map using an image that represents it, to later insert lines that lead to keywords, phrases or sentences that synthesize the information of the concept ^[18]. Each line that is added, from left to right, corresponds to one of the 8 axes of the conceptual cartography. In addition, an image should be added to each axis that represents the information of the axis (figure 4).

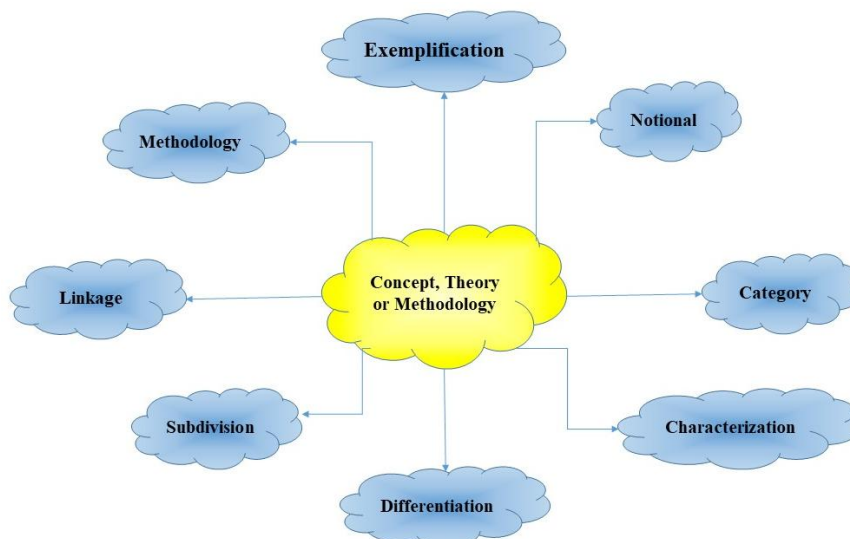


Figure 4. Schematic representation of the ideal format for conceptual cartography.

In "element 3", establishing relationships between components and axes, it answers the question: what significant relationships is important to include in the graphic map? and describe the concept ^[18]. These relationships can be established within each axis or between various axes. Now, how to account for these relationships? In the graphic map, the relationships are represented with arrows accompanying them with keywords that show the meaning of the established relationship, including images that represent the understanding of the link between the related elements.

"Element 4", textual or oral explanation of each axis, corresponds to the conceptual argument using a written text or oral communication, according to the pedagogical intention defined by the teacher for the achievement of the expected learning results. In this element, it is also possible for the student to develop the metacognitive ability implicitly associated with cognitive skills. It is more frequent to use the written text in which the information of each axis is presented, based on the bibliography that the student consulted. On the other hand, it is important to attend to the feedback to the activity and the student's learning, so that in the elaboration of the argumentative text, Tobón proposes that the student answer the following guiding questions ^[18]: "What does each image or symbol? What do the phrase and/or keywords that are on each axis mean?, Why were the phrases and/or keywords placed on each axis?, What do the relationships established consist of?, Why What relationships were placed on the map? What other relationships are possible?"

The second component that makes it possible to develop conceptual cartography is made up of the axes of analysis involved in the construction of concepts, theories or methodologies; as well as in the process of their communication. These axes show the relationships and the organization of the characteristics that constitute the concept, facilitating its understanding.

The exemplification axis consists of giving an example of the concept ^[13]. In this case, the axis can be the starting point or the closing activity of the conceptual cartography. In the first case, it focuses the cognitive activity to answer the generating question: what could be an example of the central concept of the selected competence? In this case, the student elaborates the description of concrete problems obtained from their physical, biological, psychological, social, work, professional, research, cultural context; but the description is made from their previous knowledge. In the second case, the generating question is addressed: "what could be a pertinent example of the concept? Thus, the student describes the example in detail, resorting to the co-creation of knowledge and re-linking the previous knowledge with the new knowledge that she acquired during the development of the elaboration of the conceptual cartography^[33].

The notional axis consists of describing the notion of the concept, theory or method ^[13]; so that the student elaborates an approximation to the definition of the concept. Some triggering questions are addressed, for example: What does the key concept of the competition consist of? Or, what is the typical definition of the concept? At this time, the usual definition of the concept is stated. It is important to analyze the etymology of the concept, since it makes it possible to describe the origin and evolution of the word that enunciates it, which helps to review the different meanings that the concept may have when being applied according to the social context, which will respond to the following guiding questions: what is the etymology of the concept? What is the origin of the concept? Finally, by answering the question: what could be improved in the definition? The student will analyze and synthesize the information obtained through the documentary search carried out^[33].

The categorical axis consists of classifying the concept, theory or methodology, in a larger class^[13]. In this axis, an answer is given to the triggering question: within which major process, general class or higher order, is the concept located? The answer is aimed at describing the general class of higher order concepts within which the key concept of the competence being analyzed is included. The cognitive activity that the student develops is linked to the hologrammatic principle of complete thought by recovering the perspective that the concept is part of a whole^[33].

The characterization axis consists of determining the essential characteristics of the concept, theory or methodology included in the competence^[13]; for this reason, the guiding question is initially explored: what are the essential characteristics of the concept? At this moment, the student identifies the characteristics of the concept that give it identity in the category in which it was placed. Subsequently, by asking what elements distinguish each of these characteristics? The student elaborates, describes and argues the essential components in the context of the competition^[33].

The differentiation axis consists of differentiating the concept, theory or methodology from other close concepts that belong to the same category^[13]. By exploring the question: what other close concepts that are in the same category does the concept differ from? The student identifies the similar concepts from which the key concept contained in the competition must be differentiated. In addition, when questioning: what are the differences with similar concepts? The student elaborates different propositions that show the elements that make it possible to understand the differences with similar concepts^[33].

The subdivision axis consists of determining the classes or types into which the concepts, theories or methods that are included in the competition are divided^[13]. Along this axis, the student answers the question: what are the classes or types into which the concept can be divided? But also the question about what are the distinctive elements of each of the classes or types into which the concept is divided concept? So that it elaborates and supports the explanation of the subdivision that identified^[33].

In the connection axis, the concept, theory or methodology included in the competence is related to the contributions of other disciplines and approaches^[13], so that the student, when exploring the guiding question: what are the disciplines, theories and epistemological approaches with which the concept, theory or methodology is related? Identifies and explains the relationships that semantically link the concept with different fields of scientific research, professional disciplinary lines or epistemological approaches, which allow the relevance of the concept to be expanded. In this context, it is pertinent to ask: what social, historical, economic and political processes outside the category is the concept related to? So that it will explore and explain the relationships that are identified in the concept, but placing them in the context in which the student develops, associating it with social, political, cultural, economic, professional, labor movements, among others^[33].

Finally, in the methodology axis, the essential methodology for applying the concept is described^[13]. By answering the triggering question: what are the minimum methodological elements involved in approaching the concept? The student analyzes, describes and argues in detail the elements that characterize the methodology to apply the concept in situations and context problems^[33].

Application of conceptual cartography in the classroom.

In the educational field, conceptual cartography is used with the purpose that the student develops cognitive skills and reconstructs contextual knowledge of a declarative, procedural, methodological and axiological type, so that he has the ability to structure and communicate concepts in a comprehensive way. and assertive. To concretize the communication, the student structures the concept, theory or methodology involved in the competence that must be developed and resorts to the use of propositions, notions and images that he articulates through geometric figures and lines that will represent the sense of understanding of the concept.

Contextualizing the conceptual cartography in the school classroom environment, the didactics are aimed at providing the student with a learning experience that articulates prior knowledge and their life experience related to the competence and expected learning results; so that the student will transit, according to their level of development of cognitive skills, through the following levels of performance enunciated by the socioformative approach: preformal, receptive, decisive, autonomous and strategic^[13,18,33,34].

Thus, the mediation role played by the teacher is reflected in the management of the activity carried out by the student, for which it is suggested to keep in mind the following recommendations:

1. Show the student a concrete example of conceptual cartography in a way that allows him to express doubts and questions for its elaboration.
2. Help the student in the elaboration of the conceptual cartography recovering the previous knowledge, both declarative and procedural, methodological and axiological, which will be reflected in the identification and selection of a situation of their daily life, which will also be useful to contextualize the different elements. and axes that will be developed in the activity.
3. In the process of searching, identifying, selecting, reading, analyzing and contrasting the primary and secondary documentary sources, it must help to provide the student with metacognitive elements that

allow him to identify learning needs, so that he understands the concept that is being studied. analyzing and building networks constituting a network of relationships between the concept as part of a whole. It is important to promote among students the use of guiding questions that will generate new knowledge. Table 3 shows some examples of questions generated by each axis proposed by Sergio Tobón.

4. Incorporate systematic, permanent and timely feedback to the activities carried out by the student, so as to promote resilience in the process of elaboration and improvement of the initial conceptual cartography, both in the graphic component and in the argumentative text. At this point, the student recognizes the hierarchical structure of the elements of the analyzed concept, and through the ability of radiant thinking, restructures the relationships of the selected information in an orientation that goes from the center to the periphery.
5. The final version of the conceptual cartography is based on the feedback provided to the student, the learning needs that he identified and the metacognitive recognition of his learning activity, which entails the consultation of additional bibliographic sources with the purpose that he can argue the use of verbal, non-verbal and spatial information in the construction of conceptual cartography.

Table 3: Activity and guiding questions by element and axis to prepare the conceptual cartography.

Element	Axis	Activity	Guiding questions
Concept analysis	Exemplification	Provide an example of the concept	What could be a concrete example of the central concept of the selected competence?
	Notional	Describe the notion or definition of the concept	What is the key concept of competition? What is the etymology of the concept? What is the origin of the concept?
	Category	Classify the concept in a higher class or higher category	Within which process of greater generality, greater class or higher category is the concept located?
Graphical synthesis	Characterization	Identify, determine and describe the characteristics of the concept	What are the essential characteristics of the concept? What elements distinguish each of these characteristics?
	Differentiation	Differentiate the concept from other nearby concepts	What other close concepts in the same category does the concept differ from? What are the differences with those other close concepts?
	Subdivision	Identify and determine the classes or types of the concept	What are the classes or types of the concept? What are the distinctive elements of each of these classes?
Relations	Linkage	Relate the concept with the contributions of other disciplines and approaches.	What social, historical, economic and political processes outside the category is the concept related to? With which disciplines, epistemological approaches and theories is the concept related?
Explanation	Methodology	Describe the essential methodology of applying the concept.	What are the minimum methodological elements involved in approaching the concept? What are the methodological elements required to apply the concept to real life situations?

Source: Modified from the proposal prepared by Sergio Tobón^[13,18,33].

IV. Conclusion

In the post-pandemic environment, interest is being revived in exploring paths in the educational field that allow students to develop skills aimed at applying the knowledge they acquire in school training to everyday situations throughout their lives. Topics related to the present and future praxis of the student in aspects such as: climate change, impoverishment of work activities, social coexistence, resilience, solidarity with the Other; they add to the vision of the world delimited by globalization, the knowledge society and the digital semiosphere, to configure a postmodern world where the recognition of the complexity of the anthropocene begins.

Facing the needs of daily life in this context requires education to reinvent itself and reconnect with the world of life that determines the characteristics of the student. In this sense, conceptual cartography is a resource that enables the construction of knowledge from real scenarios, where the information is multidimensional and dispersed; as well as the application of the knowledge learned in concrete situations, so that the student performs the cognitive process of understanding-interpreting-applying in the path of being-in-the-world that is shown as a complex system in which, the student is an active part of that whole called reality of a complex world.

Finally, the analysis carried out allows us to conclude that conceptual cartography is a learning strategy centered on the student, the context and the management of scientific knowledge, to build and communicate declarative, methodological, procedural and/or axiological knowledge, through delving into the study of a relevant concept, theory or methodology indicated in the cognitive competences declared in the educational program.

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