Concept maps and formative assessment: creating approaches

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Abstract
Having formative assessment as a backdrop and meaningful learning as a possible horizon, this text aims to highlight concept maps as particularly relevant tools to the intentions of training, because as a relevant teaching and learning strategy they favor the regulation of teaching and the self-regulation of learning. Revisiting the theoretical framework on this issue has favored: (a) considering the usefulness of concept maps – employed as a strategy for teaching and / or assessment – from different perspectives: the one of who teaches / assesses and the one of who learns / is evaluated, (b) assessing how much employing concept maps is to create alternatives for the organization of knowledge, by promoting educational experiences that encourage not only reflection, seeking understanding and deep processing of information, but also the development of self-regulation, of meta-cognition and of learning to learn, (c) reconsidering the importance of the means used to assess learning, which cannot be any means, but those which favor a clear perception of the learning constructed and of the learning still in progress, guiding and enabling actions to surpass prior performance, and (d) giving new meaning to the task of teaching to learn, understood as a permanent aid in the ongoing development of knowledge, by means of the disclosure of the reasons for the difficulties to be overcome.

Keywords: Assessment of learning – Teaching and learning strategies – Concept maps – Self-regulation.

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> Hope always comes out stronger in muddy waters, and the human being is much closer to scarcity than to abundance. I think we're a bit like the lotus, which, grown in the dirt, retains all the beauty of its leaves and the whiteness of its flowers.
> J. C. Pecci (1986)

Over a long period, the assessment of learning has cut the branches of the plant, pulled the seedlings that grew, left the garden to die. Undertaken in a classificatory perspective, evaluation favored – and unfortunately it still does – the disposal of people as things, legitimizing the conception that students know nothing and that they need to be taught everything. Consequently, to show the quantity and quality of learning, students have had to reproduce what is taught – word by word, syllable by syllable, letter by letter. The product has taken precedence over the process. Errors have been subject to scorn and punishment – materialized in school failure and exclusion, which reflect the triumph of one social class and its world view (Frigotto, 1989; Patto, 1990; Marchesi et al., 2004).

But time passes. Solo renovated, where the future is posed as utopia to be built, even though it has only the past as raw material. A past that is still present when the assessment actions and processes preserve the stuffiness that has no more room in a time committed to the triggering of actions and interventions that aim to contribute to the achievement of learning and development.

The concept of formative assessment has evolved, preserving its most solemn promise: to provoke and guide the regulation of teaching and learning. Initially conceived as an evaluation of the teaching means (Scriven, 1967), it was later understood as a re-measurement of the discrepancies between the actual and the desired state, in a pedagogy by objectives (Bloom; Hastings; Madaus, 1983), by triggering specific and retroactive actions (Allal, 1986). Other advances took place and formative assessment started to be considered monitoring, to foster the improvement of teaching and learning processes by providing the mapping of the learning accomplished and of that still in progress, as well as by revealing students' cognitive functioning. Then, errors were given a new meaning and, assuming pedagogical function, they started elucidating the intricacies of learning for both teachers and students (La Taille, 1997; Perrenoud, 1999; Pinto, 2000; Esteban, 2001; Hadji, 2001; Souza, 2004; 2006; La Torre, 2007; Teixeira; Nunes, 2008). Such changes also affected the purposes of the evaluation tools, and led

to their diversification and expansion. Concept maps are one of the tools used in formative assessment, because they can be one of the means to achieve an end: to ensure that students learn and develop.

Concept maps and meaningful learning

Concept maps can be a teaching and learning strategy or an evaluation tool – among other diverse and multifaceted possibilities. However, maps should not be understood or used disconnected of a clear theoretical proposition and of previously established targets. Consequently, adopting and using concept maps presuppose perspectives and personal choices related to the values, beliefs and theoretical positions which support every educational practice (Moreira, Masini, 2001; Ontoria et al. 2005; Moreira, 2000 , 2006).

It should also be noted that nothing happens unraveled of a model of education with well-defined characteristics. So to use concept maps is to make a commitment to achieve learning centered in the student, not in the teacher, to try to develop a variety of cognitive skills (not to comply with the mere repetition of information by the student) and also to aim at the harmonious development of all dimensions of the person and not just the intellectual ones (Moreira, Masini, 2001; Ontoria et al. 2005; Moreira, 2006).

The foundation of this way of structuring is meaningful learning, which is the integration of new concepts to the learner's cognitive structure "for the purpose of establishing inter-related learning" (Ruiz-Moreno et al., 2007, p. 454). Also, according to Ausubel, Novak and Hanesian (1980), meaningful learning takes place when "new information is acquired through the learners' deliberate effort to link new information to relevant concepts or propositions that already existed in their cognitive structure" (p. 159).

For meaningful learning to happen, it is therefore essential to determine what learners already know and then introduce new concepts in accordance with their prior day to day knowledge. The result, full of meaning, emerges when students, "consciously and explicitly establish links between this new knowledge and relevant concepts that they already had" (Souza, 2005, p. 2).

When learning is meaningful, it has the power to generate changes in the cognitive structure of learners, changing prior conceptions and establishing new links between the concepts.

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> Therefore, meaningful learning is permanent and powerful, while learning divorced from a context of meaning is easily forgotten and not easily applied to new learning situations or to solving problems. (p. 2)

Meaningful learning, therefore, rests on the assumption that learning new things is easier when previous concepts, which act as anchor points, are available in the cognitive structure of the individual (Moreira; Buchweitz, 1993; Cross, 2009; Ontoria et al., 2005). Previous knowledge, subsumers or inserters, appear to be nodal for the occurrence of meaningful learning because they act as indicators, as points of support for new information to gradually adapt to the learner's cognitive structure. Consequently, the new informational material will be learned and retained when referenced to concepts and propositions that are already available and will play the role of anchor points.

Underlying this conception is the conviction that, to learn more and better, it is crucial for teachers to investigate the prior knowledge of their students and to establish links with the new knowledge to be gained, after all "critical analysis of subject matter must be made thinking of the learner, [since] it is no use organizing the content in a good, logical, chronological and epistemological way if it not psychologically learnable" (Moreira, 1997, p. 18). Thus, it is necessary to offer conditions to prevent the proposed material both from conflicting strongly with that already available in the learner's cognitive structure and from being disconnected with it.

The absence or obliteration of subsuming concepts – to act as anchor points – requires the presentation by the teacher of the previous organizers, designed as introductory, more abstract, generalizable and inclusive materials, which will favor relating the material already mastered by the student to the new material to be learned. According to Moreira (1997), previous organizers are comparable to a "temporary anchorage" (p. 18).

Meaningful learning is subordinate to four principles: progressive differentiation, integrative reconciliation, sequential organization and consolidation (Ontoria et al. 2005;

Moreira, 2000, 2006). The first principle, progressive differentiation, implies a hierarchy of concepts, from the most comprehensive to the most specific, according to two hypotheses: one, that it is easier to understand and discriminate a set of characteristics of a body of knowledge when the starting point are the most comprehensive, generalizable and inclusive concepts, and the arrival point are the least comprehensive, generalizable and inclusive concepts. The second hypothesis is that learning involves the hierarchical organization of content in one's cognitive structure (Ausubel, Novak; Hanesian, 1980; Novak, 1988; Praia, 2000; Moreira, 2006). For the achievement of teaching, it is advisable to present first the general and least differentiated concepts of a subject or informational unit and the specific and particular concepts later. That way

> [...] A topic will be the mainstay idea (or ideas) which is (or are) divided into subtopics; also, in the sequence of topics, if ordered according to the principle of progressive differentiation, those which come before will provide a pillar or assimilation basis for those which come after. (Faria, 1989, p. 29)

The second principle, integrative reconciliation, involves the establishment of relationships and correlations between the concepts that make up the hierarchy, by means of the broader understanding of the distinctions and similarities that particularize them (Ausubel, Novak, Hanesian, 1980; Ontoria et al., 2005; Moreira, 2006). Following this principle in the educational context presupposes careful programming of teaching material to be used because it must be designed and organized in such a way that it favors the exploration of relationships between ideas, as well as the indication of similarities, differences and inconsistencies between them.

Sequential organization, the third principle proposed by Ausubel, Novak and Hanesian (1980), implies the organization of successive units or topics to be addressed in order to simplify the process of understanding and acquiring content. In the classroom, for the sequential organization of content, three aspects are necessary: logicality, graduality and continuity. Logicality shows the consistency of the choices, which, beginning by the most comprehensive and simple aspects of the theme, progress towards the most specific and complex ones.

Graduality, in turn, is related to "homeopathic doses," the most appropriate distribution with regard to both quality and quantity of the proposals of new information, mainly

because it should be presented based on the experience and prior knowledge of students. The third aspect, continuity, provides connections among the parts of the content, so that they will complement themselves and be integrated as teaching and learning take place. Logicality, graduality and continuity are not only aspects that guide the sequential organization of content programming, but also results of the commitment to the promotion of meaningful learning, by means of the principles of progressive differentiation and integrative reconciliation.

Finally, the consolidation principle asserts the importance of the mastery of the object of knowledge (Ausubel, Novak; Hanesian, 1980; Ontoria et al. 2005; Moreira, 2006). Knowing superficially is not enough. One needs to know significantly. Content is actually learned and grasped when the learner not only reproduces it, but draws on it to solve different concrete problems. Inside the classroom, consolidation requires the teacher's devotion to making corrections, confirmations, to promoting regulations, offering feedback etc before the introduction of another theme.

The teaching commitment to promote consolidation gives the evaluation process a sense other than the one that prevailed for long. Teachers are supposed not to merely classify, rank and subordinate people, but to unveil students' learning difficulties. Teachers are expected to take such difficulties into account in order to plot routes and actions conducive to mastery, learning, excelling and development. Thus, teachers must "roll up their sleeves" and make efforts to promote learning that is more and more meaningful, because it is founded on students' prior knowledge and it is committed to their preparation for life and citizenship.

Concept maps: a teaching and learning strategy

Learning for life. Learning to rely on the learned for the transformation of reality itself. Meaningful learning is a complex and multifaceted task that has struggled to actually be performed in many classrooms. The theory is difficult and learning it is laborious. To help teachers and students experience such theory, a tool was developed by Novak (Faria, 1989; Moreira; Buchweitz, 1993; Ontoria et al. 2005; Moreira, 2006): concept maps, understood as "hierarchical diagrams that indicate relationships between concepts. More specifically, [concept maps] can be interpreted as hierarchical diagrams that seek

to reflect the concept organization of a discipline or part of it " (Moreira, 2006, p. 45-46).

Based on the meaningful learning theory of David Ausubel, concept maps are considered important instruments for organizing and representing knowledge, as they evidence connections between key ideas through propositions or elucidative enunciations (Novak, 2008).

On maps, concepts are presented within "boxes" or any geometrical shape, while the relationships between them are specified by lines to which explanatory words or phrases are aggregated (Image 1), seeking to clarify significant propositional relationships. Therefore, to be represented, they require three elements: concept, proposition and "link word(s)" (Amoretti; Tarouco, 2000; Ontoria et al. 2005; Moreira, 2006; Almeida, 2007).

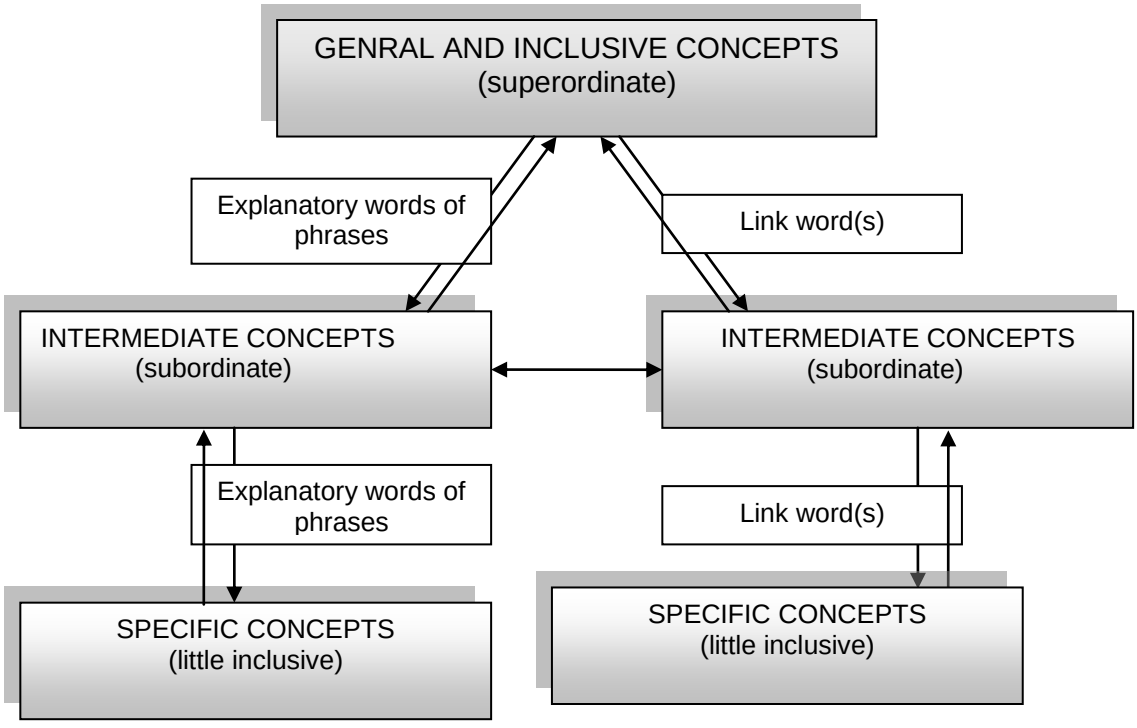

Image 1 – A possible structure of a concept map

Concepts are representations of the general characteristics of an object, which are expressed in words that describe and particularize (Novak, 1988). They may refer to events, understood as something that has happened and that can be proved, or to objects, understood as existing elements that can be observed. Also, concepts can be considered – depending on the individual's perspective – "the mental images that words

or signs with which we express *regularities* cause in us" (Ontoria, Luque, Gómez, 2006, p. 44 - emphasis of the authors).

The proposition is composed of two or more concepts united by "link word(s)" or descriptors, forming a semantic unit which clearly reveals the connections and interrelations established (Image 2). According to Ontoria, de Luque and Gómez (2006, p. 45), they constitute "the smallest semantic unit that has value of truth", because they appear as an assertion that can subsequently be asserted or denied in some of the aspects involved. Link word(s) – the descriptors – in turn unite the concepts, evidencing the type of relationship between them (Sakaguti, 2004; Menegolla, 2006; Moreira, 2006) (Image 2). These cannot be any words because their mission is to elucidate the type of relationship that exists between the concepts they unite and to offer upward, downward and horizontal readability to the map.

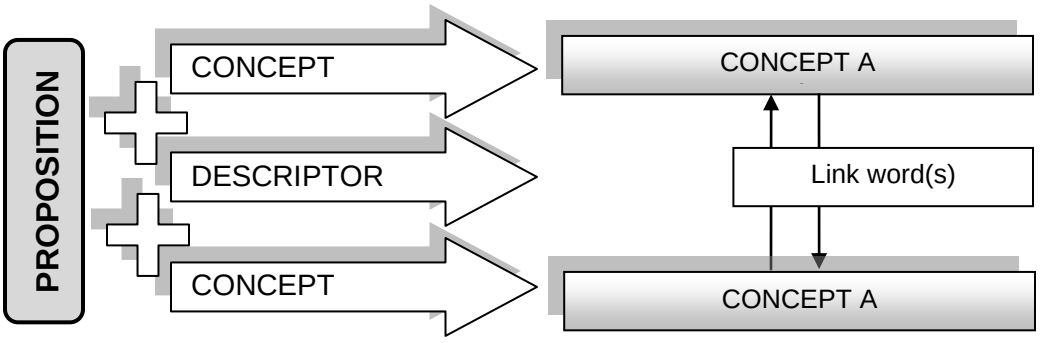

Image 2 – Constitution of propositions

Concept maps can be arranged in different forms, since each of them is only a translation of a moment of the learner. They can be one-dimensional, when composed of a list of concepts arranged vertically, or two-dimensional, when composed of a list of concepts arranged vertically and horizontally (Faria, 1989; Moreira, Masini, 2001; Ontoria et al. 2005; Moreira, 2006). One-dimensional maps are arranged vertically and linearly. They usually result from early attempts to design, so they offer a superficial and rough idea of the concept framework focused. This type of map evidences the initial arrangements of those who enter the knowledge of a theme and at the same time of a tool to represent its acquisition. When two-dimensional, concept maps denote a "step

forward" because they promote not only vertical connections – which distinguish the one-dimensional maps – but also horizontal connections, favoring "a more comprehensive picture of the relationships between the concepts [...]" (Moreira, 2006 , p. 46).

On the maps, the broadest concepts are presented in the upper part. The degree of specificity is increased as one moves towards the bottom, which covers the least inclusive concepts (Image 1), formatting and giving visibility to progressive differentiation. However, maps can be read not only downward but also upward, as well as horizontally – when the maps are two-dimensional –, favoring the exploration of the relationships between concepts (Costamagna, 2001; Moreira, 2006).

Aligned horizontally are the concepts with approximate levels of generality and inclusiveness. Establishing relationships between these concepts is more complex, mainly due to two factors: the hierarchical ordering in the vertical dimension is usually prioritized – perhaps because it seems more simple – and the interrelation of concepts demands integrative reconciliation. Integrative reconciliation is a more complex process since it entails the reorganization of the cognitive structure by the acquisition of new meanings and by enlightening, differentiation, acquisition of stability and distinctness of elements in the cognitive structure which are constant and perceived as related. Therefore, as Moreira (1997) argues,

> [...] Progressive differentiation and integrative reconciliation are two related processes that occur in the course of meaningful learning. All learning that results in integrative reconciliation will also result in further progressive differentiation of concepts and propositions. Integrative reconciliation is a form of progressive differentiation of cognitive structure. It is a process whose result is the explicit delineation of differences and similarities between related ideas. (p. 6)

As a strategy for teaching and learning, concept maps have relevant characteristics: (a) they reduce the concerns with teaching in face of the commitment to the promotion of conditions and opportunities for students to learn, (b) they allow both overcoming the "masterful pedagogy" (Perrenoud, 1999, p. 58) and assuming a pedagogy willing to respect the learners' logic to encourage the development of their autonomy, (c) they predispose to collective and collaborative work, in the course of which it is essential to negotiate understandings and meanings, (d) they value prior knowledge as the basis for

acquisition and / or extension of the concepts, (e) they evidence the progressive differentiation and integrative reconciliation processed by the learners, (f) they expand opportunities for students to use personal resources favorable to examining and understanding their learning pathways, (g) they help to achieve self-regulated learning.

Formative assessment is committed to learning, because it engages with the progression of students towards mastering knowledge and the procedures for its acquisition. According to Hadji (2001), "the evaluation should support the learning process as much as possible" (p. 15), subordinating the evaluation practice to the condition of an aid to the action of learning. For Álvarez Méndez (2002), assessment also needs "to be understood as a critical activity of learning", since it allows the teacher and the student to learn. Thus,

> Teachers learn to know and to improve their teaching in its complexity, as well as to assist in student learning [...]. Students learn about and from their own assessment and correction, from contrasted information that the teacher gives them, which will always be critical and well-reasoned, and never disqualifying or punitive. (p. 14)

Therefore, some aspects are evident when it comes to formative assessment: diversity and relevance and qualitative assessment of information collected in order to unveil the underlying reasons for errors – to enunciate learning difficulties to be faced by students. Moreover, it is essential – for the formative commitment not to be restricted to the intention – to achieve teaching based on didactic variability (Perrenoud, 2000, 2001) and learning linked to the performance of complex tasks (Scallon, 2000; Pozo; Angona, 1998; Hadji, 2001).

It is important to note also that information is produced by the implementation of various tools, and concept maps are one of them. However, such information requires interpretation and reflection in order to be the indicators that guide the work of teachers in the regulation of teaching and / or the work of students to self-regulate their learning.

Evaluating as a learning exercise (of teachers and students) requires the proposal of situations that are unique, challenging, conducive to effective teaching – adjectives which fit with concept maps understood as a teaching strategy. Moreover, it promotes the student’s commitment / involvement to address and perform various tasks which require a variety of skills and knowledge and which promote autonomous and

differentiated responses – characteristics related to concept maps, understood as a learning strategy. Thus, concept maps play a "triple role": they promote teaching, optimize learning, and evaluate teaching and learning.

Concept maps: evaluation tools

Used as evaluation tools, concept maps focus on gaining information about the structure built by learners for a set of concepts. It is therefore important to determine the concepts acquired and the relationships established between them, to precise how "they structure, rank, differentiate, relate, discriminate and integrate concepts of a particular unit of study, topic, subject, etc." (Moreira, Buchweitz, 1993 , p. 43).

Each of the maps arranged by a student – or group of students – provides evidence about the content and form of learning processed by them. Maps are important to promote meaningful learning not because they are right or wrong, but because they are constantly being changed in line with the repositioning processed in the learner's cognitive structure. With every new look, the map is modified, adding dynamicity and progressivity to teaching and learning.

By favoring the identification of the knowledge acquired by the student, concept maps guide the teaching actions and interventions, improving teaching and expanding learning. So, first of all,

> [...] Map analysis is essentially qualitative. The teacher, instead of bothering to assign a score to the map drawn by the student must seek to interpret the information given by the student on the map in order to get evidence of meaningful learning. (Moreira, 2006, p. 8)

Evaluating formatively is to commit to forward the student to pathways that will foster advances in understanding new concepts, refining previous concepts and overcoming learning difficulties, precisely because evaluating formatively leads teachers to

> […] Observe students more methodically, understand their work better in order to adjust educational interventions and their teaching situations in a more systematic and individualized way, aiming at optimizing their learning. (Perrenoud, 1999, p. 89)

Grasping the outline of the steps taken by the student is subordinate to the quality and functionality of the triggering tasks – considered by Hadji (2001) those which meet the

requirements of relevance and significance – because they make the achievement of goals and learning more observable. Therefore, the choice of activities capable of capturing and revealing the concepts mastered, as well as the mental procedures undertaken, is nodal if the intention is to carry out formative evaluation. Because concept maps encourage the teacher and students to seize these two aspects – the content mastered and the learning process experienced – they can be as an excellent trigger, since

> [...] the main idea of using maps in the assessment of learning processes is to assess learners in relation to what they already know, using the concept constructions that they have managed to create, that is, how they have structured, ranked, differentiated, related, discriminated and integrated concepts [...]. (Gava; Menezes, Cury, 200 -, p. 2)

Therefore, concept maps favor the achievement of formative assessment, as several studies have evidenced (Costamagna, 2001; Araújo, Menezes, Cury, 2003; Sakaguti, 2004, Barbosa et al. 2005; Souza, 2005; Fernandes Júnior, Dias, 2006; Vosgerau, 2006; Almeida, 2007; Lopes, 2007; Marriott; Torres, 2007, Ruiz-Moreno et al. 2007; Moreira, Soares, de Paulo, 2008; Cogo, 2009; Correa, 2009; Nascimento ; Silva Júnior; Cordeiro, 2009; Silva et al., 2009). They enable teachers to understand students' contexts by generating the identification and analysis of errors, together with the promotion of a more accurate diagnosis of the cognitive functioning involved. As a result, concept maps can provide more accurate indicators for the reconstruction of pedagogical work, for the regulation of teaching and for the self-regulation of learning.

Concept maps, used as an evaluation tool and according to the formative purposes, have the following characteristics: (a) they promote frequent and high quality feedback that activates the cognitive[1] and meta-cognitive[2] processes of learners, (b) they facilitate the regulation of teaching and the consequent promotion of teaching variability, (c) they

[1] Cognitive processes involve the understanding of the procedures adopted for the processing and encoding of information (Boruchovitch, 2004). They cover the identification of learning achieved and of that still underway, and the cognitive procedures undertaken for both.

[2] Metacognitive processes "refer to behaviors and thoughts that influence the learning process so that information can be stored more efficiently" (Boruchovitch et al., 2006, p. 297). Thus, they involve planning, monitoring and regulation of one's thinking by the learner in order to optimize the achievement of goals.

place the error as a step in the learning process, transcending the dichotomy between knowing and not knowing, as well as promoting the building of bridges between what is considered important to teach and what can be learned, (d) they expand the involvement of students with the management of their learning pathways, improving their self-esteem and increasing their motivation, and (e) they encourage the self-regulation of learning, creating conditions for students to progressively take responsibility for their learning.

Concept maps, employed as an evaluation tool, are not meant to measure an object, nor merely to allow the passive gaze of a situation. Mixed with learning strategies, they clarify how the expectations are consolidating in learning and then make teachers and students responsible for managing their progress: teachers conducting the teaching and students preparing and using self-regulation strategies.

Concept maps and self-regulation of learning

Living and learning processes are not soft or gracious. Indeed, they are demanding processes because they involve the restructuring of the already known by the insertion of new information and because they require recognizing the achievements and the opportunities for growth that still exist, to invest in them, regulating oneself. Self-regulation entails, as Bandura (2008) explains, exerting "influence on oneself," because individuals become willing to "monitor their behavior, judge it in relation to some personal standard of merit and react to it" (p. 27). Self-regulation is therefore related to the idea of self-control and self-direction. Two ideas underlie. The first one is that it is essential to understand internal and transactional psychological processes according to which it is possible to manage actions. And the second one is that the effort of action self-management is subordinate to goals and aspirations, aiming at reaching the desired point, the desired achievement.

According to Perrenoud (1999), self-regulation of learning is the management by the students of "their projects, their progress, their strategies in the face of obstacles and tasks" (p. 97). It is to some extent the process of committing oneself to excel, to one’s own transformation, regardless of the awards and rewards which come from the others.

In promoting more self-regulated learning, concept maps contribute to "the acquisition, storage and / or use of information" (Boruchovitch, 1999, p. 3). By allowing students to understand the meaning of content, the maps enable them to relate the new information to their prior knowledge. Also, during their preparation and comparison with other productions, maps favor the students' continuous assessment of what they are performing and, as a result, the students' efforts to learn what has just been enunciated as a possibility. This way, they favor the occurrence of a "deep processing" or learning by restructuring, which is the mental activity that leads to the "construction of new knowledge in the form of new propositions," in such a way that

> [...] The new knowledge produced (ie, built and learned) is not a copy of the stimulus received by the senses nor the repetition of what was already known. It is a new formulation marked by the peculiarities of the learners, depending on their prior knowledge [...]. (Bzuneck, 2004, p. 35)

Concept maps are a sophisticated learning strategy, which is the organization. They are not limited to the transmission of information, which characterizes associative strategies and superficial processing (Pozo, 1996; Boruchovitch, 2001, 2004; Boruchovitch et al., 2006). They transcend the preparation in the course of both simple tasks (one-dimensional maps) and complex tasks (two-dimensional maps). The organization is based on the establishment of "internal [relations] between the elements that comprise the learning materials (Pozo, 1996, p. 191).

As cognitive strategies for organizing knowledge, concept maps bring about numerous meta-cognitive gains, since they mobilize students to plan, monitor and regulate their own thinking and their own actions. In the course of their composition, during their confrontation with other maps and their reconfiguration, students are led to think critically about their achievements and the cognitive pathways chosen to produce the outcomes. Thus, working with concept maps makes it possible to continuously and gradually learn to think about their thinking and their achievements, to develop the capacity to know themselves – cognitively, procedurally and emotionally.

Self-regulation, however, stems from not only the students or their approach to the task, but also from the teaching situation. It is essential to arouse interest, meet some need, based on a purpose, promote the autonomy of accomplishment and the analysis of

processes and results. Self-regulation does not fit with overwork and lack of time or with the demands of learning in occasional and closed rituals which lead to the mere reproduction and the habit of studying for the test. Self-regulation fits with concept maps, both when taken as a teaching strategy and when placed at the service of formative assessment.

Weaving considerations

Concept maps are an excellent strategy for teaching and learning, as well as an excellent evaluation tool, since in the course of their structuring and restructuring, there are cognitive conflicts and room for becoming aware of discrepancies, problems, difficulties, errors, which, when analyzed, compared, discussed and explored, become opportunities for advances, for surpassing prior performance and even for regulation and self-regulation. As a strategy for teaching and learning, concept maps cannot be perceived as routine. Because no matter how efficient, effective and relevant a particular strategy seems to be, its value is relative given the need for teaching variability, according to students' different rhythms and ways of learning.

As evaluation tools, concept maps facilitate the teacher's and students' perceptions of the identification and acquisition of the most relevant concepts in an informational context, the assertiveness of the relationships established between them, as well as the outline design of the quality of the changes processed in the learner's cognitive structure. And most importantly, this stems not from a concern with the scores, but from the formative commitment to the regulation of teaching – the teacher's task – and the self-regulation of learning – the student's task.

Using concept maps as a teaching and learning strategy and, concurrently, as an evaluation tool, makes it possible to follow the student during diverse and simultaneous processes:

> [...] of learning (looking for new information), learning to learn (reflecting on learning procedures), learning to live together (interacting with others), learning to be (thinking about oneself as a learner). (Hoffmann, 2001, p.139)

Using concept maps is also making a commitment to the promotion of educational experiences that provoke reflection and a search for understanding of the concepts under construction, because the error is now seen as a diagnostic indicator to be interpreted to guide actions conducive to surpassing prior performance and to advancing.

There is no repetition or linearity in the work with concept maps. Each production is a surprise, because it is unique in what it represents as a revelation of a learning pathway and a structure built – even when under constant reconstruction. Perhaps the only constant aspect in the work with concept maps is inconstancy, after all, discoveries, questions, continuity, progress, resumptions, embarrassment and surpassing appear all the time.

Concept maps relativize the points of arrival, without belittling or denying them, when they recognize the value of monitoring the pathway closely observing the crossing points, when they argue that learning is an ongoing and individual process, when they say that learning is a unique and singular experience of the learner, even if it occurs in solidarity with others.

As a strategy for teaching and learning and an evaluation tool, concept maps meet the requirement of taking into account what was already, in order to gauge how much one has advanced toward the target, but in doing so, they still prevent the one who draws them up from remaining inert, because they push towards recomposition, rework, search for information, knowledge sharing – giving materiality to formative assessment. After all, the past reveals the surpassing processes. And the means used to unveil it may give alternatives, possibilities, strengths and will to move forward with the expectation and certainty of surprises inherent to learning.

Looking into the topic concept maps, enjoying the spaces that they offer the pedagogical work, has made it possible to grasp their usefulness when used as a teaching, learning and formative assessment strategy. It has favored measuring the value of maps for the proposition of alternatives for organizing knowledge, for the promotion of educational experiences conducive to reflection, to understanding, deep processing of information, development of self-regulation, and the expansion of meta-cognition. It has evidenced that it is possible to aggregate two important tasks into a single educational activity.

Such tasks are: teaching to learn and learning to learn. It has helped perceive how important it is to use the adequate means to promote assessment which, overcoming the check, is a means of learning for teachers and students. It has confirmed the certainty (or hope) that it is essential to make use of evaluation activities conducive to teaching and learning, because such activities are understood and used as a permanent aid for the development of knowledge.

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