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## Models for the comprehensive analysis of metacognition; implications in teaching career management

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### Abstract

Studied in different learning contexts, metacognition, defined as thinking and reflecting on one's cognitive processes, favours academic success and lifelong learning performance. Although there is a wealth of information on the development of metacognition in pupils and students, research on adults' metacognitive awareness, how to support it, or the role it can play in their professional development are limited.

The article comprehensively analyses the concept of metacognition and metacognitive models. Thus, we carried out a review of the models that highlight the structural elements of metacognition, in order to optimize the processes of monitoring understanding and those of control, of self-regulation of the teaching career management.

The study aims to facilitate the process of understanding the concept of metacognition, how conceptual meanings have evolved and generated models based on structural elements, through the interaction of which professional development is facilitated. The comprehensive approach to metacognition represents the vision underlying the development of the study, which generates future principles and guidelines for the design of a professional development programme, centred on the metacognitive development of teachers.

*Keywords: conceptual analysis of metacognition; multidimensional analysis models of metacognition; metacognitive development in adults; teaching career management.*

### Research and innovation in metacognition

In the specialized literature, the problem of studying metacognition arose as a result of the concern for identifying ways to improve memory (Flavell, 1970; Brown, 1975), the way to achieve regulation as effectively as possible, to support and optimize the learning process (Winne & Nesbit, 2009; Zimmerman & Moylan, 2009), as well as oral information communication strategies. These premises of metacognition have played an important role in: language acquisition and reading comprehension (Williams & Atkins, 2009), mathematics (Dignath, Buettner & Langfeldt, 2008; White, Frederiksen & Collins, 2009; Sahin&Kendir, 2013) and in problem solving (Jacobse&Harskamp, 2012). At the same time, "the ideas about metacognition are beginning to come into contact with similar ideas in the fields of social learning theory, cognitive behaviour modification through different types of self-control and self-instruction, personality development and education" (Stancescu, Draghicescu& Petrescu, 2018, p.93). Thomas O. Nelson and Louis Narens (1996) consider that "metacognition is both a topic of interest in itself and a bridge between domains, for example, between decision-making and memory, between learning and motivation, between learning and cognitive development" (Metcalf & Shimamura, 1996, p.1).

The official name of the term metacognition appeared in the works of J.H. Flavell, giving metacognition a general definition of "knowledge about cognitive phenomena", with an emphasis on the information that a person has about his/her own cognitive processes, about their products and about everything that connects us to them (Flavell, 1979, p. 906). Introducing in his studies the concepts of cognitive monitoring and control, Flavell elaborated the theory of metacognition, by which he claims that "metacognition refers, among other things, to the active evaluation, to the regulation and organization of these processes according to the cognitive objectives or the data they usually assume to serve a specific purpose or objective" (Flavell, 1976, p.232). Studies highlight the importance of awareness of metacognitive processes and strategies in memory development, because it is

essential “to know about knowledge and to know how to know” (Brown, 1975). Thus, the concept of metacognition or metaknowledge represented the ability to reflect on cognition, as well as the appreciation of how cognition occurred.

Studies of metacognition prior to the 1980s were dominated by developmental process research (Flavell, 1979), whereas experimental studies in the 1980s and 1990s were dominated by cognitive psychologists interested in already formed processes in adults (Perfect & Schwartz, 2002, p.15). Metacognition was very succinctly described by J. Delacour as “the ability to represent one’s own cognitive activity, to evaluate its means and results, to adjust it to different types of problems or situations through the deliberate choice of strategies and rules”(Sălăvăstru, 2009, p. 186). In A.L. Brown’s view, the concept of metacognition has two dimensions: it designates both the knowledge that a subject has about his/her own cognitive functioning and the mechanisms of regulation or control of cognitive functioning. Over time, metacognition has evolved and combines the learning theories of cognitivism and constructivism. In this view, metacognition refers to “the ability to understand, control and manipulate our cognitive processes”(Osman, Hannafin, 1994).

In the last three decades, the sample of research in the metacognitive field has expanded considerably, but the use of the term metacognition has not moved away from the original meaning and “most researchers subscribe to the idea that metacognition involves processes that monitor and increase the efficiency of cognitive procedures” (Akturk&Sahin, 2011; Van Zile-Tamsen, 1996; apud Craig et al., 2020, p.156).

In general, cognitive psychology defines metacognition as “the knowledge that the subject has about the functioning of his own cognitive system that can optimize its functioning. For Raynal (1997), metacognition represents “the analysis of one’s own intellectual functioning; analysis (or self-analysis) of the information processing systems that any individual engages in order to learn, remember, solve problems, or conduct an activity”. Schneider appreciates that “this concept refers to the knowledge that people have about their own information processing abilities, as well as knowledge about the nature of cognitive tasks and the strategies used to cope with such tasks. Moreover, it also includes executive skills related to monitoring and self-regulating one’s own cognitive activity” (Borca C, 2015, p. 308).

In addition to the mentioned basic meanings, A.H. Schoenfeld believes that metacognition is the reflection, the intuition of how to solve a task, problems, situations. This also includes the identification of negative aspects, typical mistakes, in order to then avoid them, based on the connections that can be made consciously, controlled, in different contexts, through self-regulation. At the same time, it is emphasized that it is a process, an intentional activity of the monitoring subject, continuous control of the information processing mechanisms, the specifics of the problems, their realization, leading to the formation of certain beliefs, to an awareness of them (feeling of knowing), to a familiarization with their level. That is why metacognition is also correlated with introspection, with self-evaluation, self-analysis, self-reflection, rational self-highlighting, self-correction (Joita, E., 2002, p. 178). Also, in research on metacognition, Darling-Hammond and Ball (1998) identified two aspects of metacognition: reflection and self-regulation.

Metacognition is important in educational research because of its ability to provide the individual with the skills to monitor, control, and ideally improve their own thought processes.

Thus, the emphasis is also placed on the methods and strategies for developing metacognition in pupils/students/teachers (Yildiz&Akdog, 2017). Metacognition is also used in professional fields, due to the fact that it involves the awareness of one’s own learning process through self-control, self-appreciation and self-improvement activities, in order to transform the conditions of knowledge and learning. Once adults gain expertise and learn how to use a range of metacognitive skills in one domain, they can use some of those skills to learn more quickly in another domain.

Studies on the development of metacognition in teachers are few, being focused on the component elements and metacognitive strategies. They reveal the impact of metacognitive skills on the successful management of the class, on the process of self-regulation of learning and improvement of the real activity, the development of the feeling of self-efficacy.

### **Characterization of models of multidimensional analysis of metacognition**

Metacognition is a multidimensional structure, incompletely explored until now, which offers researchers the opportunity to present different taxonomies in the identification and classification of information and processes, especially since its applications are in a continuous expansion.

1. *Flavell’s model of cognitive monitoring* (1979) includes four interactive components: metacognitive knowledge (knowledge about people, knowledge about tasks, knowledge about strategies), metacognitive experiences (ways to apply metastrategies), goals (tasks), and strategies (metacognitive activities). Metacognitive knowledge refers to the individuals’ belief in their learning, their desire to learn, strategies to complete a task, and

the individual's cognitive attempts and knowledge consist of variables such as functional information and strategic information (Flavell, 1979; Lai, 2011). According to Flavell (1979), metacognitive experiences are defined as “any waking consciousness that accompanies and belongs to a cognitive intervention and an affective experience” (p.906). Activities and strategies are defined in terms of knowledge and behaviours to achieve goals. Objectives and tasks are the results of a cognitive effort, and “metacognitive thoughts”, as Flavell (1979) points out, “are deliberate, planned, intentional, and behaviours are mentally oriented towards the future, to be used in the realization of cognitive tasks” (Cerghit, p.246).

**2. A.L. Brown's metacognitive model.** Around the same time Flavell was exploring this new conceptualization, Ann Brown wrote a paper entitled *Knowing When, Where, and How to Remember: A Problem of Metacognition* (Brown, 1978). She focused on the importance of metacognition as a distinct entity in the study of developmental cognition and learning. Brown framed metacognition in effective thinking, considering it to consist of several basic characteristics: “prediction, checking, monitoring, reality testing, and coordinating and controlling deliberate attempts to learn or solve problems” (work cited 1978, p.78). According to Ann Brown (1980), metacognition is composed of two dimensions: knowledge of knowledge and regulation of knowledge. Knowledge information is divided into three categories: declarative knowledge, procedural knowledge, and conditional knowledge. Cognition regulation refers to a set of activities that help learners regulate and monitor learning, that facilitate the control or executive aspect of learning (Brown, 1987), involving metacognitive strategies: planning, monitoring and evaluation strategies.

**3.** Flavell's view of metacognition was completed by Pressley, Borkowski and Schneider (1989), who proposed an elaborate model of metacognition, the *Good Information Processing Model*. The model considered aspects related to declarative and procedural metacognitive knowledge and linked these concepts to other characteristics of information processing. According to this model, metacognition is in a close relationship of interdependence with: learning strategies and the automatic use of effective learning procedures used, motivational orientation, general knowledge about the world (Schneider, 2008).

Borkowski et al. (2000) proposed a model in which the characteristics they identified (based on specialty literature review and empirical evidence) develop and interact; the process is cyclical and interactive. The unique aspect of the model of good information processing lies in the successful integration of the main components of the metacognitive system –including cognitive, motivational, personal and situational characteristics. As Borkowski and Muthukrishna (1992) have argued, most components of metacognition are or can be developed and reshaped through carefully planned classroom and home learning experiences that begin early and continue throughout life.

#### **4. The metacognitive model of Jacobs and Paris**

Jacobs and Paris (1987) consider metacognition to be composed of two subcategories:

- Self-evaluation—is mainly based on the individual's personal thoughts and ideas, which means that self-evaluation is similar to one's own information about cognition management; refers to the static evaluation of what an individual knows about a particular domain or task. Self-evaluation was divided into three categories: declarative knowledge (what is known in a propositional manner), procedural knowledge (awareness of thought processes, as a fundamental aspect of metacognition), and conditional knowledge (the conditions that influence learning, such as why which strategies are effective, when they should be applied and when they are appropriate).
- Self-management refers to the dynamic aspects of translating knowledge into action. Three types of executive processes may comprise the activities of self-regulated thought: planning – the selective coordination of a cognitive means with a cognitive goal. (Baker, 1985); evaluation— continuous process in any domain – readers can assess their own understanding while pausing, paraphrasing, answering questions or summarizing information; adjusting – a person must monitor progress and then revise or modify plans and strategies based on how well they are working. Self-regulation enables adaptation to changing task demands as well as successes and failures.

**5. The metacognitive model of T.O. Nelson and L.Narens (1994)** is one of the most influential alternative models for metacognition. The model is structured on two interrelated levels: a top level (metalevel) and a target level (object level). There is a symmetrical relationship between these two levels and there is a two-way flow of information. In the information flow, if a problem occurs at the target level, monitoring is enabled. According to this model, the meta-level receives information from the objective level through metacognitive monitoring (Dunlosky, Rawson, Hacker, 2002). Monitoring refers to the process of supervising and verifying the quality of the learning activity by referring to the established goals. During metacognitive control, the top level informs the objective level of information so that either a new action is initiated, or actions already started are continued or, on the contrary, are completed.

Nelson (1996) identified four components of metacognitive monitoring:

1) judgments estimating the difficulty in learning/estimating performance in the following tasks (ease of learning judgments - EOL); they take place before the learning period and are concretized by estimates of the difficulty in learning a specific content or information;

2) judgments of learning progress (judgments of learning – JOL) – are defined as evaluations that take place during and after the learning process and that constitute predictions about performance on a subsequent test that measures knowledge about the studied items;

3) judgments evaluating the degree of knowledge of the answer (feeling of knowing – FOK) – are expressed by assessing the extent to which a content that is currently forgotten or cannot be updated, will be updated/retrieved from memory later, being correlated with the strategies used by individuals to answer the questions, specifically an increased level of these judgments is reflected in taking longer to find/update the answer;

4) confidence judgments in the given answer (confidence judgments – CJ) – aim at the degree of confidence of individuals in successfully completing some learning tasks and can be measured either as predictions, through prospective monitoring that takes place before solving a learning task, either as postdictions, through retrospective monitoring that takes place after solving the learning task or retrospective judgments of confidence in the given answer (Mihalcă, 2015, p.17-18).

The model of metacognitive functioning proposed by Nelson and Narens (1994) is suggestive through the way metacognition is represented, observing the presence of a system, a structure, as well as the existence of multilevel processes and transformations (Frumos, 2008, p.83). Winne (2001) considers metacognitive monitoring to be the pivot on which self-regulated learning rests, as it involves an evaluation of the level of understanding and progress towards achieving goals that has effects on how individuals approach learning tasks and make adaptive changes in the process for studying.

#### 6. *Schraw and Moshman's metacognitive model*

Analysing and developing Brown, Schraw and Moshman's model (1995) presented a new model as well as the Metacognitive Acquisition Inventory. They consider metacognition to have two dimensions: knowledge about cognition and its regulation.

According to Schraw (1998, p.114), cognition knowledge refers to "the individual's own knowledge and general knowledge about what they know about knowledge". This includes three subcategories, namely:

- declarative knowledge – knowledge about the situations that individuals are affected by, their own cognitive system and what they know or do not know, or whether they are doing their duty or not (Schraw, 2000);
- procedural knowledge – knowledge about how individuals would apply their learning processes and problem-solving strategies (Schraw, Dennison, 1994). Because procedural knowledge provides individuals with knowledge about how to use and regulate information, those with advanced procedural knowledge perform tasks more automatically, they have a broader strategic repertoire, and have a greater opportunity to use different strategic techniques while solving problems (Schraw, 1998);
- conditional knowledge refers to the information that individuals have about their learning processes, when and why they are used and their limitations (Schraw, Dennison, 1994). Conditional knowledge helps to effectively improve the selection of cognitive sources, to use strategies effectively, and to make changes according to needs. Thus, people with a high level of conditional knowledge are considered efficient enough to determine the most appropriate strategy in the learning process (Schraw, 2001).

According to Schraw (1998), knowledge regulation is the behaviour that controls cognitive knowledge and consists of five main components: planning, information management strategies, monitoring, coping strategies and evaluation (Schraw & Dennison, 1994).

7. *Tobias and Everson's metacognitive model*(2002) consists of planning, selecting strategies, evaluating learning, and monitoring information. These stages must be continuously monitored. When a person is able to use their metacognitive ability, they can improve their learning and knowledge about their own knowledge, allowing for its self-regulation and gaining autonomy for future learning; people who have effectively developed metacognitive skills can estimate their knowledge in many different domains, following its lifelong learning, dynamically updating their knowledge, and planning for new learning in the future (Everson, Tobias, 1998).

### **Metacognitive development and teaching career management**

The teaching career management is an issue of the teacher training process, cognitively based on the pedagogy of competences and the field of professionalization of the teaching career, value-oriented by the social expectations regarding the teaching profession and normatively regulated by the educational policies and strategies in the field of teacher training.

The problem of the lifelong training of teaching staff and the development of the teaching career has a remarkable scope today, being a permanent concern for specialists, which is reflected in the exponential growth of research in the field and in the diversification of professional training program offers. This interest has increased with the reforms and efforts made to establish innovative education systems for teachers and for their professionalization, by outlining educational strategies in this sense and allocating substantial resources to support projects and programmes in the field of professional development.

Educational studies and practices in the field reveal the need to resize the curriculum of lifelong training of teachers through the self-management of professional development, by referring to the dynamics of social expectations and the diversification of one's own educational needs. Thus, a major contribution offered by the application of new paradigms is represented by metacognition, reflective ability and critical thinking, which are the essential attributes of a teacher for a successful career (Doherty, Hilberg, Epalooseşi Tharp, 2002; Boisvert, 1997; Méard& Bruno, 2009).

Metacognition is one of the key elements on which teachers' professional progress is supported, facilitating individuals' abilities to possess and effectively use teaching career management strategies. Through metacognitive skills, teachers can assert their capacities for planning, control and monitoring, as well as for regulating the professional development process.

In teaching career management, **metacognition offers a series** of methods and techniques of self-analysis, self-evaluation, self-reflection and self-regulation, self-development of professional development directions, as well as the skills necessary to build a successful career. Metacognition is one of the key elements that facilitate individuals' ability to possess and effectively use effective professional development management strategies, identify weaknesses, and build new career development skills/capabilities.

Metacognition requires active learning, based on research, investigation with the aim of developing cognitive capacities, taking the form of an "internal dialogue", a reflection on what the student does, how he/she does it and why he does it. In this cognitive self-knowledge, achieved by the learner/trainee, the following factors intervene: to know as much as he knows; to know what he/she knows; to know what he/she needs to know; to know how to use the right strategies. So, metacognition is built step by step, as it represents both the knowledge of one's own cognition (what I know, what I can do, what I still have to do, what I need to know, etc.), and its regulation (how to do, how to motivate myself, monitor, evaluate, etc.). Metacognitive skills allow the beneficiaries to control their investigative efforts, to rediscover the need for cognitive and professional affirmation, to redefine their own self, strengthening their self-esteem, becoming more curious, open, more motivated to learn throughout life.

The use of metacognitive methodology in teaching career management within lifelong education programmes offers multiple possibilities for collaborative learning so that teachers can talk, listen, discuss and learn with their colleagues. It also provides the opportunity to make them observe themselves, their professional performance and how they present themselves in the educational environment in which they work. As Mateos (2001) has shown, a reflection on the teaching action itself is the most promising way for teachers to effectively adjust their teaching strategies and can thus approach the goal of "learning". The optimal development of metacognitive skills is essential for professional development throughout the entire teaching career, as well as for the ability to transfer these metacognitive processes to students.

Within the teaching career management, the development of teachers' metacognitive skills offers a series of long-term advantages, such as:

- They perfect critical thinking through a reflective educational practice;
- They facilitate the process of self-regulated learning (McCormick, 2003), as well as that of effective teaching (BenDavid& Orion, 2013);
- They improve teaching techniques through the meta-perspectives they offer on the training process;
- They increase teachers' didactic skills (Fathima et al., 2014);
- They provide insights into career planning in the process of identifying career needs, aspirations and opportunities.

## Conclusions

Teachers face multiple challenges during the training process, as well as in the exercise of the profession, which makes it necessary to develop new capacities, knowledge and specific skills. Through specific elements of metacognition (self-knowledge, self-analysis, self-questioning, criterion-referenced self-examination, self-appraisal, self-monitoring, self-regulation, self-control, self-leadership and self-reflection), teachers must manage their thinking to learning, understanding themselves as students throughout life and at the same time they must

be change managers, analysing their practices to introduce relevant improvements, continuously advancing as professionals (Matsumoto-Royo et al., 2022).

Due to the important role it holds in different areas of knowledge, as well as in career management, we believe it is essential that training programmes target to a greater extent the awareness of teachers' involvement in their own professional development and the development of their metacognitive skills. The theoretical base is vast, but pedagogical sciences offer few examples of good practices when talking about metacognition in adults and its implications in professional development. Thus, more research is needed to facilitate understanding the way teachers' metacognitive awareness can influence teaching career management.

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