MAPPING METACOGNITION, LESSON PLANNING AND REFLECTION FOR TEACHING AND LEARNING

EL USO DE MAPAS PARA LA METACOGNICIÓN, LA PLANIFICACIÓN DOCENTE Y LA REFLEXIÓN EN EL PROCESO DE ENSEÑANZA-APRENDIZAJE

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ABSTRACT

The aim of the paper is to provide a useable framework for mapping lesson planning, reflection and metacognition with the process of teaching and learning. The outcome of this process takes the form of a planning, monitoring and reflection (PRM) map that can help trainee teachers to make a systematic evaluation of their teaching and to reflect on the instructional process as constructively as possible. The intention for using the PRM map is to stimulate trainee teachers' reflection to evaluate selected aspects of the four main domains of learning: cognitive, affective, psychomotor and metacognitive. The whole process will promote reflective thinking and will help trainee teachers to create a rich source of ideas to turn to when making decisions about the cognitive and metacognitive strategies they and their students[2] might use for the task.

Key words: Metacognition; Reflection; Planning; Strategies.

RESUMEN

El presente trabajo pretende proporcionar un marco útil para la planificación de la docencia, la reflexión y la metacognición usando mapas para el proceso de enseñanza y aprendizaje. El resultado de este proceso toma la forma de un mapa de planificación, seguimiento y reflexión (PRM por sus siglas en inglés), que puede ayudar a los docentes en formación para realizar una evaluación sistemática de su enseñanza, así como a reflexionar sobre el proceso de instrucción de la manera más constructiva posible. La finalidad de emplear los mapas PRM radica en estimular la reflexión de los docentes en formación para evaluar determinados aspectos de los cuatro dominios principales de aprendizaje: cognitivo, afectivo, psicomotor y metacognitivo. El proceso en su conjunto promoverá el pensamiento reflexivo y permitirá que los docentes en formación obtengan una rica fuente de ideas que pueden emplearse a la hora de tomar decisiones acerca de las estrategias cognitivas y metacognitivas que ellos y sus estudiantes (desde los 10 hasta los 19 años) pueden emplear para realizar sus tareas.

Palabras clave: Metacognición; Reflexión; Planificación; Estrategias.

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[2] From the age 10 to their late teens.

1. Introduction

A necessary condition for trainee teachers is to be able to plan good lessons, to monitor teaching and learning and to reflect on how well each of the learning tasks and strategies has worked for them and their students. Most trainee teachers find lesson planning stressful, time consuming and difficult to reflect and assess the effectiveness of each teaching and learning strategy. The classical cycle followed by trainee teachers is planning, teaching and reflecting after teaching. This is a difficult cycle for them and they need close support and guidance from mentors and classroom teachers. Conventional structures of the lesson plans (John, 2006) impede reflection and they do not enhance metacognition. In addition, they do not provide evidences about how much students are learning or the 'effectiveness of the teaching' (Dunn et al., 2010:1). Many trainee teachers view them as a script to be created and followed step by step. In general, the dominant model in lesson planning is a linear model, broken down into segments defined by time and then by content, teaching methods, resources and assessment techniques alongside.

Wilson's (2010:1) study suggests that teachers' metacognitive knowledge had a 'significant impact on their pedagogical understanding of metacognition'. Therefore, the purpose of this paper is to suggest an alternative model of lesson planning which will give trainee teachers the possibility to be metacognitive and to think about applying metacognition during the course of lesson planning. The author has created a new metacognitive map, the planning-monitoring-reflection (PMR) map, which is a tool design to engage trainee teachers with pedagogical understanding of metacognition. Task planning, monitoring, checking and reflection are manifestations of metacognitive skills that can be acquired, practiced and executed by trainee teachers while using the PRM maps. In addition, these maps will allow trainee teachers to plan engaging teaching and learning strategies, which are responsive to students' learning needs and intentions for the work to be done.

All learners are engaged in a variety of learning activities during their life, such as discussion in small or large groups, practical work, reading texts or study for exams. The main role of a teacher is to select appropriate strategies to the learning activities or tasks and to bridge the gap between content and skills to be learned. This role requires a clear understanding of the task to be completed, as well as knowledge of the appropriate cognitive and metacognitive strategies to be used. Pintrich et al. (1990) make a clear distinction between cognitive and metacognitive strategies, the first one includes rehearsal, elaboration, organisation, critical thinking, while metacognitive strategies include, planning, monitoring and regulating. When teachers are involved in the planning, selection and reflection on these strategies, they can develop a better understanding of learning, teaching and thinking processes. The processes of lesson planning and teaching are similar with phases of problem solving: understanding, planning, reflecting. These processes are supported by the use of cognitive and reflection tools, such as journals or concept maps. In addition, the concept maps support metacognitive processes (Cicognani, 2000; Novak, 1990) and students' awareness and understanding of their learning processes (Daley, 2002).

Trainee teachers who enter a teacher-training course are "novice teachers" because they often take a surface approach towards lesson planning, metacognition and reflection on teaching and students' learning. For the vast majority of these trainee teachers, lesson planning and teaching is strongly influenced by their beliefs, intuitions and attitudes about learning and metacognition. In speculating about ways cognition might be applied to teaching, a number of researchers have proposed different models and approaches. For example, Biehler (1994) has suggested that teachers can make the instruction as effective as possible if they follow four steps such as taking into consideration prior knowledge, specifying the learning objectives, assessing students' learning and providing instruction by taking into consideration the cognitive strategies and motivation. Furthermore, both trainee teachers and teachers during the first years of their teaching career do not properly apply metacognitive processes in their classroom (Nool, 2012). They possess particular beliefs, or mental models, about knowledge and aptitude. Costa and Kalick (2008) refer to these mental models as "habits of mind." These habits determine whether individuals perceive themselves as in control of their learning or not. Based on this information, a person's willingness to learn and engage in metacognitive strategies is not so much linked to aptitude or experience, but rather attitude. Artzt and Armour- Thomas (1998) research shows that teachers' metacognitive knowledge plays a well-defined role during lesson planning and teaching.

2. Mapping metacognition and reflection

Metacognition is present in our lives whenever we reflect upon our knowledge and thinking process. What we know about our own thinking process or thought processes and how that knowledge, or lack of it, affects our learning, is a general description of metacognition. There are various definitions of metacognition; some authors have considered metacognition as a second level of cognition (Brinol and Demarree 2012:1) which can magnify, attenuate and reverse the impact of first-order cognition. Others define metacognition as one's ability to understand, control and manipulate one's thinking (Meichenbaum, 1985), or divide the metacognition into three facets: knowledge, monitoring and control (Dunlosky and Metcalfe, 2009). According to Flavell (1979) and Kuhn (2000), metacognition is composed of two parts, metacognitive knowledge and metacognitive regulation. Metacognitive knowledge is defined as the knowledge that controls the thinking process and in turn is composed of the knowledge of person variable, task variable and strategy variables. Metacognitive knowledge is 'knowledge about knowing' (Nickerson et al., 1985:101), what we plan and do in executing a task. Metacognitive regulation, on the other hand, is about monitoring and regulation of cognitive processes.

Reflection is an essential and integral part of metacognition and it makes the connection between metacognitive knowledge and self-regulation. According to Ertmer and Newby (1996), reflection has a direct impact on metacognitive knowledge and it is essential to development of expert learners. They connect the process between metacognitive knowledge and self-regulation through reflection or metacognitive control. Cornoldi's (1998) approach to metacognition and reflection is that `metacognitive reflection' involves beliefs, perceptions and under-standings of a problem or cognitive task or activity. Teachers' beliefs and interpretation of a cognitive activity is part of metacognitive reflection and it is driven by the conceptualisation of a task. For example, the metacognitive reflection incorporates the knowledge of strategies with the self-regulatory processes such as monitoring and reflective judgments. High levels of mental activities are necessary to promote and facilitate problem solving in various complex situations (Tarricone, 2011). Such complex processes are supported by the control of teaching-learning relationship and self-efficacy in teaching. These are elements of the metacognitive attitude, which is a subcategory of metacognitive knowledge and has a strong impact upon metacognitive reflection (Cornoldi, 1998). Metacognitive attitude cannot exist without some form or level of reflection because it has important implications on how we develop reflection about our own cognitive activity.

Both metacognition and reflection seem to be difficult concepts for both teachers and students to grasp. Like many other researchers, Brown et al. (1980, p.27), while working on how to devise learning activities to help students learn to learn, have found out that metacognition has become of interest due to the fact that most children are not very efficient learners and because they have limited knowledge of the 'necessary strategies to engage in appropriate learning activities'. Leaf's (1983) research indicates that teachers prefer to use a traditional cognitive sequential approach to teaching and learning, such as controlling the way students receive and use the transmitted prescribed content, and then test if they have received it. This might be due to the fact that trainee teachers do not understand the meaning of metacognition or they might be confused or uncertain as to the significance of metacognition. The implication is to find an accessible way for teachers to incorporate metacognitive skills and strategies as a necessary part of their daily planning, teaching and reflection. There are many models of metacognition such as the self-regulated approach (Borkowski et al., 2000) and the reflective judgment model (Kitchener and King, 1990), but the central components of all of them are the metacognitive skills, such as planning, monitoring, testing, revising, evaluating, critical thinking and decision making. Furthermore, if both teachers and students are trained to reflect on their teaching and learning processes, they will gradually develop metacognition skills (Bransford, 2000).

Research in student learning (Riding, 1994) suggests that cognitive styles influence the focus and type of an individual's activity. Understanding and applying different thinking strategies depends on the abilities of learners to engage in formal thinking. These characteristics typically do not appear before the age of twelve. Therefore, if we are going to teach students between age ten to twelve, we will need to give specific instructions suitable for concrete thinkers if we want them to use learning strategies. If we are going to teach in the higher secondary grades and adults, we might find it beneficial to introduce students to metacognitive strategies as we assign different kinds of learning task, by giving suggestions and examples about how they should study.

3. The planning-monitoring-reflection map

The new instructional tool, the planning-monitoring-reflection map (PMR) map, on its own is a metacognitive tool that encourages trainee teachers to think reflectively about teaching and learning process and systematically analyse strengths and weaknesses of learning tasks and teaching strategies. The process of creating these maps involves making decisions about the way learning relates to teaching strategies, leading the trainee teacher to reflect on chosen strategies as well as how it relates to the process of planning and pedagogies that combine both cognitive and metacognitive components. By planning and sequencing the tasks according to students' understanding, motivation and interest, trainee teachers will activate metacognitive processes.
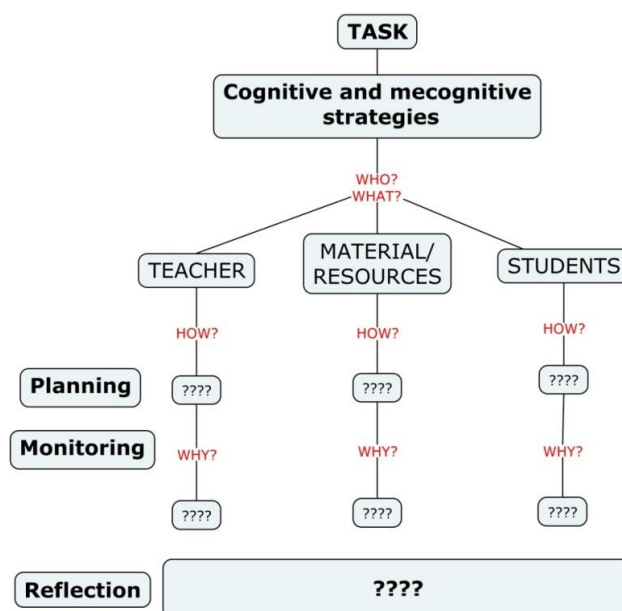

Figure 1 The basic structure of the planning-monitoring-reflection (PMR) map

The structure of the PMR map is based on Flavell and Wellman's (1977) metamemory model that is central to planning, monitoring and regulation of learning tasks. The metamemory model has been referred to us as the foundation of metamemory and metacognition theory (Tarricone, 2011) and includes three key variables: person, task and strategies. An accurate development of knowledge and awareness of tasks will interact and affect memory storage and retrieval. As a result, the complexity of the task and its success depends upon effective memory and strategies. Basic PRM maps, as shown in Figure 1, consist of four essential parts: the task, the cognitive and metacognitive strategies, the skills and metacognitive prompts. Three essential regulatory skills are necessary for the creation of this map: planning, monitoring and reflection. The PMR maps propose a different hierarchical arrangement of the three variables: firstly the task, then the person (teacher and student), the material or resources, and the corresponding cognitive and metacognitive strategies and skills. Step one involves the planning and monitoring of strategies. Step two focuses on an assessment process and reflection. These steps will provide trainee teachers with metacognitive knowledge and skills and will encourage them to monitor and reflect on each cognitive and metacognitive strategy planned for a learning task. In turn, this process will help students to improve their learning across subject areas and to apply metacognition to their own instruction and assessment.

In classroom practice, the trainee teacher will complete a map for each learning task. During the first component of metacognition, the planning, trainee teachers list the cognitive and metacognitive strategies for the learning task, the resources and materials. In addition, the map will include prompts on how to use each strategy and why to use it. The idea of this structure is to foster the development of explicit declarative,

procedural and conditional knowledge about each strategy. When a student is confronted with a learning task, it is helpful for a trainee teacher to analyse the time, criterion and attributes. These steps will help trainee teachers and students to extend their cognitive and metacognitive strategies repertoires and make them aware of cognition and metacognition.
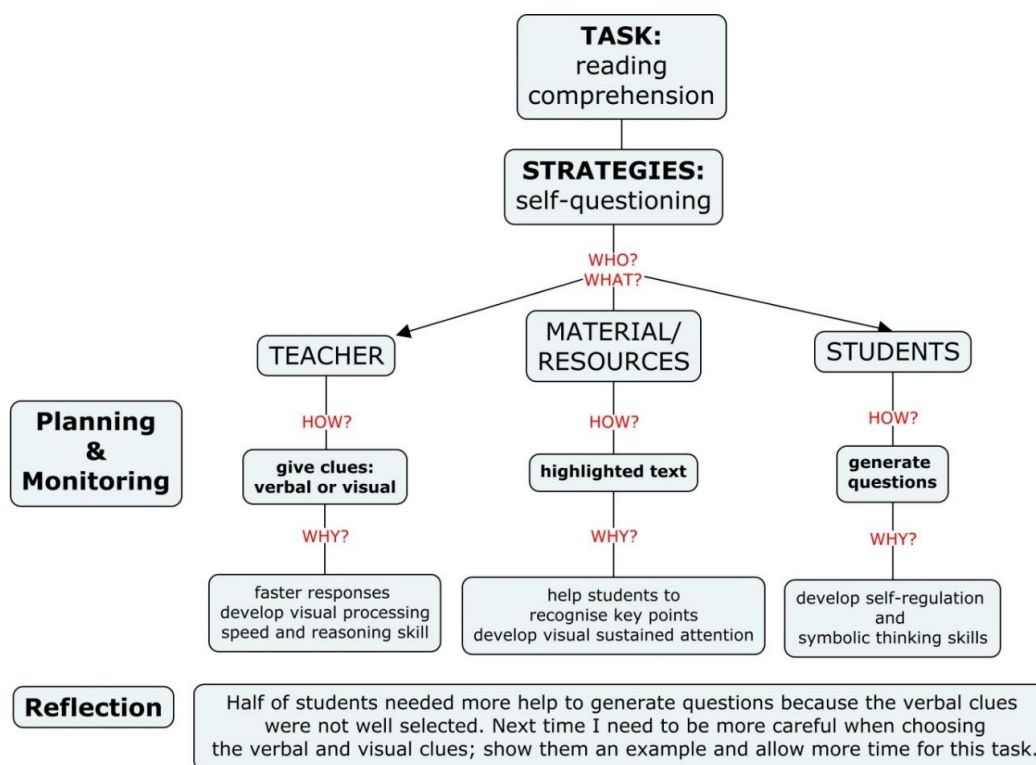

Figure 2. Example of a PMR map for a reading task

For example, comprehension is one of the two main processes of reading and relies on a specific set of cognitive skills such as attention, memory, thinking and self-regulation. The self-questioning strategy can help students to perform this complex task and understand what they read. The use of cognitive strategies, i.e., verbal and visual clues given by the trainee teacher and the highlighted text, can increase the efficiency with which the student approaches the learning task. Remembering, classifying, constructing questions are additional strategies that can be added by student to the map. In the classroom, the trainee teacher can communicate to the learner the answers to the 'why' questions related to each strategy. This requires a very good understanding of the task to be completed, as well the knowledge of each strategy that can be used to approach the task. This is a very good way to teach students metacognition. A trainee teacher, who teaches cognitive strategies well, will connect learner and task and when he/she teaches metacognitive strategies, will connect the leaner with thinking about thinking.

Since metacognitive processes are linked with cognitive strategies, metacognitive prompts can be added to the map to encourage trainee teachers to plan and identify possible difficulties during the learning process. All these prompts take the form of questions and hints, which will remind trainee teachers to be constantly aware of students' cognitive and metacognitive abilities. Each step will increase trainee teachers' ability to create, so it becomes a way of facilitating creative thinking, as a process of development for trainee teachers. As well as impacting upon the trainee teacher, these prompts may also exert some effect upon learners in determining the extent to which they imply different thinking strategies. Both, trainee teachers and learners become aware of their own thinking skills and strategies and the way these might affect the learning tasks, thinking and teaching strategies.

Because metacognition does not develop automatically in all students, teachers play an essential part in its development. Teachers at least should teach students how to regulate their learning processes before they hand over responsibilities for learning to them (Schoenfeld, 2001), and for obvious reasons this is especially important for students who do not have metacognition at their disposal without any help to support their own and learner's cognitive and metacognitive activities, to help on planning and reflection. Students can be also helped by teacher to create a PMR map; this map can help them to improve the metacognitive control under the general categories of planning, monitoring and evaluating. For example, teaching students how to make their own PMR maps for solving problems, creating, organising, exchanging information and thinking, will help them to see the learning as an internal construction process controlled by themselves, not as a process control solely by teachers.

The PMR map is designed as a visual metacognitive support tool for trainee teachers to include opportunities for metacognition in their instruction, to understand and evaluate the values of certain cognitive and metacognitive strategies, and how to properly complete the learning task. The cognitive taxonomy suggests that well devised strategies can encourage learning based on knowledge, translation, interpretation, comprehension and application up to learning based on analysis, synthesis and evaluation. The affective taxonomy suggests that well devised strategies can encourage learning based on interest, up to receiving or engaging, responding or committing, valuing or internalising, organising a value set or interpreting, and characterising by a value complex or evaluating.

4. Research possibilities and conclusion

The intended purpose of the PMR maps is to establish a bridge between planning, reflection and metacognition. Teachers can use this guided PRM map in the first years of their teaching to plan and evaluate their lessons and to organise the learning tasks to facilitate meaningful learning. The map is intended to meet the need of a teacher to find solutions that might be use to improve students' personal engagement in the learning, thinking and metacognitive processes. Developing a PRM map for each learning task will help the teacher and learner to gain clear understanding of key cognitive and metacognitive strategies to be used. Working through the PRM map from the task up to the metacognitive reflection, provides scaffolding for subsequent learning and facilitates the creation of a powerful learning and teaching framework. In addition, these maps can give permanence and stability to the student's thoughts and become an extension of their mental activities.

The PMR map will be used as a research tool for new empirical studies to investigate how mapping reflection and planning supports metacognition and how it affects the lesson planning. It will also be a useful research tool to represent the interactions between the categories of metacognition, providing a more informed understanding of metacognition by teachers.

References

Biehler, R. (1994). Teacher education and research on teaching. Introduction. In R. Biehler, R. W. Scholz, R. Straesser & B. Winkelmann (Eds.), *Didactics of Mathematics as a Scientific Discipline* (pp. 55-60). Dordrecht: Kluwer.

Borkowski, J. G., Chan, L. K. S., & Muthukrishna, N. (2000). A process-oriented model of metacognition: Links between motivation and executive functioning. In G. Schraw & J. C. Impara (Eds.), *Issues in the measurement of metacognition* (pp. 1-41). Lincoln, NE: Buros Institute. Bransford, J. (2000). *How people learn: brain, mind, experience, and school.* Washington DC: National Academies Press.

Brinol, P. & Demarree, G. (2012). *Social Metacognition*. Hove: Taylor and Francis Group

Brown, A., Campione, J. & Day, J. (1980). *Learning to learn: On training students to learn from text.* Boston: American Educational Research Association

Cicognani, A. (2000). Concept mapping as a collaborative tool for enhanced online learning. *Educational Technology and Society*, 3(3), pp.150-158.

Costa, A. & Kallick, B. (2000). Discovering and Exploring Habits of Mind. Association for Supervision and Curriculum Development

Daley, B. J. (2002). Facilitating learning with adult students through concept mapping. *Journal of Continuing Higher Education*, 50(1), pp. 21-31.

Dunn, R., Craig, M., Favre L., Markus D., Pedota P., Sookdeo G. & Stock J. (2010). No Light at the End of Tunnel Vision: Steps for Improving Lesson Plans. *The Clearing House*, 85, pp.194–206

Dunlosky, J., & Metcalfe, J. (2009). *Metacognition*. Thousand Oaks: Sage.

Ertmer, P. A., & Newby, T. J. (1996). The expert learner: Strategic, self-regulated, and reflective. *Instructional Science*, 24(1), pp.1-24.

Flavell, H. (1979). Metacognition and cognitive monitoring: A new era of cognitive-development inquiry. *American Psychologist*, 34, pp. 906-911

John, P.D. (2006) Lesson planning and the student teacher: re-thinking the dominant model, *Journal of Curriculum Studies*, 38(4), pp. 483-498

Kitchener, K. & King, P. (1990). The reflective judgment model: ten years of research. Commons, M. and Armon, C. (eds.) *Adult development*. (pp.62-78). New York: Praeger.

Kuhn, D. (2000). Metacognitive development. *Current Direction in Psychological Science*, 9, pp. 178-181

Leaf, C., Louw, B & Uys, I. (1998). An Alternative Non-Traditional Approach to Learning: The Metacogntive-Mapping Approach. *Die Suid-Afrikaanse Tydsrif vir Kommunikasieafurykings,* 45, pp.87-97

Meichenbaum, D. (1985). Teaching thinking: a cognitive-behavioural perspective. In Chipman, S., Sagal, J. & Glaser R. (Eds*) Thinking and learning skills, vol. 2: Research and open questions*. Hillsdale, NJ: Lawrence Erlbaum Associates

Nickerson, R., Perkins, N. and Smith, E. (1985). *The teaching of thinking*, Hillsdale. NJ: Lawrence Erlbaum Associates

Nool, N. (2012). Exploring the Metacognitive Processes of Prospective Mathematics Teachers during Problem Solving. *International Proceedings of Economics Development & Research*, 30, p.302

Novak, J. (1990). Concept maps and Vee diagrams: Two metacognitive tools to facilitate meaningful learning. *Instructional Science*, 19(1), pp. 29-52

Pintrich, P.R. & Johnson, G.R. (1990). Assessing and Improving Students 'Learning Strategies. *New Directions for Teaching and Learning*, 42, pp. 83-91, DOI:10.1002/tl.37219904209

Riding, R.J. (1994). *Personal Style Awareness and Personal Development*. Birmingham: Learning and Training Technology

Schoenfeld, A. H. (2001). Mathematics education in the twentieth century. In Corno L. (Ed*.), Education across a century: The centennial volume* (pp. 239–279). Chicago: University of Chicago.

Tarricone, P. (2011). *The Taxonomy of Metacognition*. Hove: Psychology Press

Wilson, N. & Bai, H. (2010). The relationships and impact of teachers' metacognitive knowledge and pedagogical understandings of metacognition. *Metacognition Learning* 5, pp. 269–288, DOI: 10.1007/s11409-010-9062-4