Psicothema 2009. Vol. 21, nº 1, pp. 76-82
www.psicothema.com

ISSN 0214 - 9915 CODEN PSOTEG

The role of metacognitive experiences in the learning process

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Metacognition in the form of metacognitive knowledge (MK) —in this case, beliefs about learning— provides a database from which the learner can select strategies for the regulation of learning. However, strategic regulation presupposes that the learner is aware that learning is not progressing well, or fluently, or has failed. This awareness takes the form of metacognitive experiences (ME), that is, feelings, estimates, or judgments related to the features of the learning task, of the cognitive processing as it takes place, or of its outcome. The critical feature of ME is their affective character which gives them access both to the cognitive and the affective regulatory loop of behavior. Being part of the affective loop, ME are related to motivation and self-processes; being part of the cognitive loop, they are connected to MK and to metacognitive skills, the latter being declarative and procedural knowledge. Thus, ME offer awareness that links the present with the past learning experiences and facilitates or inhibits self-regulation of learning in the present as well as in the future.

El papel de la experiencia metacognitiva en el proceso de aprendizaje. La metacognición, entendida como conocimiento metacognitivo —en este caso, creencias acerca del aprendizaje—, aporta la información en base a la cual el aprendiz selecciona las estrategias apropiadas para regular el aprendizaje. No obstante, la regulación estratégica presupone que el aprendiz es consciente que el proceso de aprendizaje no discurre por los cauces adecuados, no fluye, o que simplemente ha fracasado. Esta conciencia toma la forma de experiencia metacognitiva, es decir, sentimientos, estimaciones o juicios relativos a las tareas de aprendizaje, sobre cómo tiene lugar el procesamiento cognitivo, así como su resultado. El aspecto crítico de la experiencia metacognitiva es su carácter afectivo, el cual facilita el acceso a los componentes cognitivo y afectivo del bucle regulatorio de la conducta. Como parte de la dimensión afectiva del bucle, la experiencia metacognitiva tiene que ver con la motivación y los procesos del yo; como parte de la dimensión cognitiva del bucle se vincula con el conocimiento y las habilidades metacognitivas, lo que posteriomente dará lugar al conocimiento declarativo y procedimental. Por tanto, la experiencia metacognitiva supone la conciencia que une las experiencias de aprendizaje presentes y pasadas y facilita o inhibe la autorregulación del aprendizaje en el presente y en el futuro.

In the past, in the behaviorist tradition, learning was conceived of as a purely cognitive phenomenon, involving the building of associations between stimuli and between stimuli and responses (Deese & Hulse, 1967). The associational conception of learning was gradually broadened to encompass acquisition of conceptual knowledge and understanding, acquisition of complex skills and strategies, as well as using one's knowledge to solve problems. From this point of view, learning is equivalent to thinking, that is, a goal-directed process making selective use of available information in the environment or in memory and processing it in a way that is guided by the goal set. Moreover, learning is situated, taking place in a particular context and being constrained by it (Volet & Järvelä, 2001). Thus, learning does not automatically generalize across situations and does not always lead to a successful learning outcome, even if it were successful in a specific situation. The outcome of the learning process each time depends on the availability of required knowledge (declarative and procedural knowledge, namely cognition) as well as on the goal set, on the proper sequencing (i.e., planning) of the procedures to be applied for reaching the goal, on the monitoring and control of cognitive processing, and on the evaluation of the processing outcome whether it satisfies or not the goal- and the performance-criteria set. This approach to learning is called *self-regulated learning* (Schunk & Zimmerman, 1998), and presupposes that the self is involved in and guiding the learning process.

Self-regulated learning involves, besides cognition, motivation, which is related to the setting of goals by the person and his/her engagement with the learning task. It also involves metacognition —that is, monitoring and control of the person's cognition— as well as evaluation of the learning outcome and reflection on his/her self as learner. Moreover, it involves volition that secures persistence and fulfilling of the learning-related action in face of obstacles (Kuhl, 1985; Zimmerman, 1998). More importantly, however, the notion of self-regulated learning denotes that learning is a dynamic process. This process has a preparatory phase in which the learning goal is set and the task/situational

Fecha recepción: 3-7-08 • Fecha aceptación: 25-7-08
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demands are decoded and appraised vis-à-vis the person's competence to deal with them. Then a phase of planning and carrying out of the decided actions takes places, followed by a phase of evaluation and reflection on the learning process, its outcome, and the self as learner (Schunk & Zimmerman, 1998).

In this article I will argue that learning also involves affect, namely emotions, feelings, and attitudes which, along with motivation, provide the drive for self-regulation. Moreover, I will argue that metacognition regulates cognition not only through the cognitive regulatory loop, as is usually assumed, but also through the affective one. This approach to learning allows us, as researchers and educators, to have a more integrated view of the learning process, so that we can help students to adapt and progress as self-regulated learners. The emphasis will be on metacognitive experiences and their relations with affect and motivation so that we can better understand the mechanism of self-regulation in learning situations.

Self-regulated learning, metacognition, and affect

Self-regulated learning, being closely related to one's self and one's goals and not only to the objective characteristics of the learning task, is associated with affect, because success or failure in it has implications for one's self and self-perception of competence. The learning task represents an achievement situation, which triggers achievement-related emotions in students (Pekrun, Elliot, & Maier, 2006; Pekrun, Goetz, Titz, & Perry, 2002), such as interest, boredom, enjoyment, hope, fear, and anxiety. These are activity-related emotions, which are distinguished from outcome-related emotions such as pride, shame, anger, etc. These emotions trigger approach or avoidance behaviors and may facilitate or hinder learning depending on their strength and frequency.

However, there are also feelings that are being experienced in a learning situation. These feelings are related to features of task processing —such as feeling of knowing, feeling of familiarity, feeling of difficulty, etc.— or to the outcome of task processing, such as feeling of confidence, and feeling of satisfaction. These feelings are called «metacognitive feelings» (because they focus on cognition) and have a hedonic quality; the action tendency, however, attached to them is not urgent as it happens with emotions (Efklides & Volet, 2005; Frijda, 1986). Feelings are the product of a monitoring function (Efklides, 2006; Efklides & Volet, 2005; Pribram, 1999) that informs the person on the need for control decisions rather than leading to action directly as it happens with emotions.

Metacognitive feelings are part of metacognitive experiences (ME), which constitute one of the three facets of metacognition —the other being metacognitive knowledge (MK) and metacognitive skills (MS). All three facets of metacognition are critical for self-regulated learning but in education, up to now, the emphasis was mainly on MK and MS. This was probably so because, on the one hand, the role of ME in self-regulation was not well understood and, on the other, educators focused on the control of cognition rather than on the monitoring of it. However, monitoring of cognitive processing is the prerequisite for the exercise of control. Specifically, the monitoring of the developing cognitive processing is reflected in the person's ME; the person, by making use of his/her MK, decodes the meaning of his/her ME —particularly of the metacognitive feelings— in order to make control decisions. These decisions are then implemented through cognitive and metacognitive strategies (i.e., MS). In this way the person self-regulates his/her learning process in the short run, but his/her ME and control decisions also have a bearing on long-term self-regulated learning.

The facets of metacognition

Metacognition was defined by Flavell (1976, 1979) as cognition of cognition and by Nelson (1996) as a model of cognition. This means that metacognition is a representation of cognition, the latter being the direct and sole determinant of behavior (Stuss & Benson, 1986). Metacognition, functioning at a «meta» level, refers to cognition, which forms the object-level. Metacognition is, then, informed by the object-level through the monitoring function and informs the object-level through the control function (Nelson, 1996). This implies that metacognition does not have direct access to behavior, but does so only through cognition. The nature of metacognition, namely that it is a representation of cognition and that control decisions are based on this representation, implies that control will be successful to the extent the model of cognition is accurate. Since this model is not necessarily accurate or the control decisions are not always implemented at the cognitive level, as I will explain, it is possible that metacognition will fail to support a successful behavioral outcome. This can explain the discontent of many educational researchers who had thought that metacognition would be the easy way to improve learning behavior. In fact, a lot of research in the 1980s and 1990s showed that teaching of memory strategies did not lead to improved memory performance (Schneider, 1985).

To explain these findings it is important to understand that metacognition is not a direct reflection of cognition, but a model of it based on the monitoring of the functioning of cognition. Monitoring of cognition takes place continuously at a nonconscious implicit level and regards the functioning of cognitive processes vis-à-vis the person's goal. However, monitoring of cognition can also take place at a conscious level through observation of the person's behavior, actions, and awareness of his/her inner states, such as thoughts, feelings, emotions, wishes, goals, beliefs, etc. Observation and awareness of mental states along with language use allow the person to reflect on and analyze his/her inner states, behaviors and actions as well their outcomes. It also allows the person to communicate the content of his/her reflection to others, to draw inferences and to make attributions about the relations between inner states and observable behaviors and outcomes, and to compare his/her personal inner state and explanations with those of other people. This leads to the building of a socially shared and socially negotiated model of cognition based on successive «meta-levels» and rational analysis of the models represented at the meta-levels as, e.g., in science (Newell, 1990).

The representation of cognition (that, is metacognition) is already present at young children of 4 years of age when they develop what is called «theory of mind» (Wellman, 1990), although its precursors are already present at the age of two years (Bartsch & Wellman, 1995) or even earlier. Theory of mind is critical for understanding one's own and others' cognition and also for successful communication and social exchanges. It is built on the child's awareness of his/her inner states vs. the external world and vs. other people's inner states; therefore, it has a strong

experiential basis (Harris, 1992), which is always present, even if theory of mind is gradually transformed to a set of beliefs about cognition (Bartsch & Wellman, 1995). Thus, the model of cognition that develops from theory of mind is containing information about the child's ME and not only beliefs about cognition. As children grow, theory of mind is further differentiated, reflected on, negotiated, and shared with others leading to more refined, detailed and presumably more accurate representations of cognition, both of the conceptual content of knowledge and of the functioning of cognitive processes. The model of cognition depicted in theory of mind is captured in what Flavell (1979) called «metacognitive knowledge».

Metacognitive knowledge

Based on the process outlined above, namely on self-awareness or awareness of subjective mental states, on observation of behavior and of its outcomes, and on the use of language to depict them and to communicate with others about them, a differentiated representation of cognitive processes takes place according to the functions they serve, e.g., language, memory, learning, attention, thinking (Fabricius & Schwanenflugel, 1994), leading, thus, to specific models of each one of them.[1] This kind of knowledge is part of the person's metacognitive knowledge (MK), which is declarative knowledge stored in memory (Flavell, 1979). Most importantly, MK also encompasses information regarding *persons* (the self and the others as cognitive processors as well as their ME), *tasks*, *strategies*, and *goals* (Flavell, 1979). This means that we store in memory and we retrieve from it information on how we or other persons process various tasks, how well we performed on them, what we felt during the task processing, when, why, and what kind of strategies were used (i.e., what were the conditions or the critical task features and demands that dictated the use of a particular strategy), and what kind of goals people have when dealing with a task or a situation. This kind of MK provides a database from which the person can select information that fits with his/her conception of the task and of the goal pursued when automatic cognitive processing fails and the person needs to control his/her cognition.

Moreover, as children acquire theory of mind and become aware that reality is distinct from the representations of it and that representations of reality can differ between people and can be wrong or inaccurate, the foundations of *epistemological beliefs* are laid. Epistemological beliefs develop as schooling and reflection on knowledge itself make the child aware of truth or falsity, of constraints of knowledge (e.g., situational, personal, cultural), and of the criteria for deciding on the reliability and validity of knowledge. Epistemological beliefs are crucial for the critical appraisal of one's and others' thinking and reasoning, of one's and others' knowledge, and of one's and others' beliefs and theories about the world. Although they are often implicit, formal epistemological criteria are explicit and built as scientific thinking and rational construction of knowledge takes place at the social level of thinking.

In sum, MK is product of offline monitoring of cognition and consists of beliefs, theories (implicit or explicit), and declarative knowledge about cognition and about the person's ME and strategies when processing various kinds of tasks in order to serve a variety of goals. Being based on the person's self-awareness as well as on reflection and socially shared «theories» (Nelson, Kruglanski, & Jost, 1998), MK is continuously updated. Yet, MK is not necessarily accurate —it is a construction that uses information from a lot of different sources— nor fully explicit, because a large part of it is the product of nonconscious abstraction and inferential processes. Being declarative, MK can be accessed and reported, as long as it is explicit, and can be called in to support the control of cognition when cognitive processing fails. On the other hand, MK, such as models or theories about cognition and about persons, can control behavior and action implicitly through expectations that influence the interpretation of situational and task demands.

Moreover, MK of strategies, being also declarative in nature, cannot be readily applied on task processing (Schneider, 1985) unless it is proceduralized. In fact, children often use cognitive strategies without being aware that they do so (Fabricius & Schwanenflugel, 1994; Robinson, 1983). Later on, as they become aware of their strategies, they can apply them purposively and in a self-regulated manner. However, if MK of strategies was acquired in a declarative fashion through, e.g., instruction, then proceduralization is needed before it can be used to process information, solve problems, or guide the person's action and behavior.

In general, the way MK is acquired and used is still not well understood, particularly because it interacts with the other facets of metacognition, that is, metacognitive experiences and metacognitive skills.

Metacognitive experiences

Metacognitive experiences (ME) are manifestations of the online monitoring of cognition as the person comes across a task and processes the information related to it. They are the interface between the person and the task. They comprise metacognitive feelings, metacognitive judgments/estimates, and online task-specific knowledge (Efklides 2001, 2006). Examples of metacognitive feelings are: feeling of knowing and its related «tip-of-the-tongue» phenomenon, feeling of familiarity, feeling of difficulty, feeling of confidence, and feeling of satisfaction. Examples of metacognitive judgments/estimates are: judgment of learning, estimate of effort expenditure, estimate of time needed or expended, estimate of solution correctness. Also, episodic memory judgments such as Know/Remember/Guess, source memory (where, when, and how we acquired a piece of information), or estimates of frequency and recency of memory information are part of the ME persons have with respect to parameters of information stored in memory. The online task-specific knowledge comprises task information that we attend to and use, e.g., the words used as well as ideas or thoughts that we are aware of as we deal with a task, and MK that we retrieve from memory in order to process the task, e.g., MK about the tasks and procedures that we used in the past, comparison with other tasks, similarities, differences, etc.

What distinguishes online task-specific knowledge from the other ME is that it is cognitive and analytic in nature unlike metacognitive feelings, which are affective and cognitive in nature at the same time (Koriat & Levy-Sadot, 1999). The affective character of ME can be explained by two feedback loops (see Carver, 2003; Carver & Scheier, 1998). The first one is related to the outcome of cognitive processing and detects the discrepancy from the goal set. The higher the discrepancy from the outcome

the more the negative affect experienced. On the contrary, the closer the person comes to his/her goal the more satisfied s/he feels; this is a positive affective state (Efklides & Petkaki, 2005). The second feedback loop, which is called «meta-loop», monitors the *rate* of discrepancy reduction, that is, the rate with which one progresses towards one's goal. The meta-loop gives rise to affect (positive or negative) and a hazy expectancy about the effect of the rate of progress towards one's goal. Thus, feeling of difficulty, which denotes interruption of processing, is associated with negative affect whereas feeling of familiarity with positive affect (Efklides & Petkaki, 2005).

Feeling of confidence, on the other hand, is related to the outcome of processing, as feeling of satisfaction does, but differs from it because it is based on information from two sources: the estimate of solution correctness and the feeling of difficulty (Efklides, 2002b). Feeling of difficulty is related to the fluency of processing, i.e., the way the solution/response was produced: fluently or with interruptions. This may explain the subtle differences between the various outcome-related ME, namely estimate of solution correctness, feeling of confidence, and feeling of satisfaction. Estimate of solution correctness is an estimate based more on MK and is associated with negative affect (Efklides & Petkaki, 2005) that supports a critical attitude and analytic thinking (Kuhl, 2001). Feeling of confidence is affected by estimate of solution correctness and feeling of difficulty, whereas feeling of satisfaction is related to feeling of confidence. However, since feeling of satisfaction is related to the standards associated with the goal set, it can be the case that the person is not satisfied even if feeling of confidence is high. This could happen, for example, in the case of perfectionists, who raise the standards all the time and thus the outcome of cognitive processing, although correct, is still discrepant from the goal set. In contrast, the person can be confident and satisfied, even if the outcome of cognitive processing is not correct, just because the response was produced fluently. In such a case, there is no critical appraisal of the outcome correctness because the person does not have or does not use his/her MK regarding the task, or because the standards regarding the quality of the processing outcome are low. Thus, the person considers that the goal set has been accomplished but objectively the outcome is not the correct one.

Moreover, metacognitive feelings are nonanalytic and products of nonconscious feedback and inferential, heuristic processes. Usually they are momentary, transient, and go unnoticed. But if they are strong and persist, then the person becomes aware of his/her feelings and this awareness gives rise to conscious analytic processes as to their source, their implications for cognitive processing, and the need for action and regulation of behavior (Koriat & Levy-Sadot, 1999). Thus, in order to give meaning to their metacognitive feelings the person may use his/her MK regarding persons and tasks, and/or make attributions about their source. This is particularly evident with feeling of difficulty. When one feels difficulty often cannot readily identify why this feeling is experienced, that is, if it is caused by lack of understanding of the task demands, lack of relevant declarative or procedural knowledge, conflict with previous knowledge or response, or coming to a dead-end during processing. In all these cases there is an interruption of processing or lack of fluency in the processing of the task that gives rise to unpleasant affect experienced as feeling of difficulty (Efklides, 2002a). Awareness of this feeling denotes the need for increased effort in order to restore processing; this is the reason why feeling of difficulty and estimate of effort are highly correlated (Efklides, 2002a). Of course, if feeling of difficulty is very strong, then the cue is that the person cannot proceed with the task and the task should be abandoned. On the contrary, when the task is familiar and processing runs smoothly, then the person experiences pleasant affect and low or no feeling of difficulty (Efklides & Petkaki, 2005).

Furthermore, ME can provide the input that activates metacognitive skills that control action and behavior (Efklides, 2002a). For example, feeling of difficulty can be attributed to task complexity, to task demands, or to lack of personal competence to deal with the task. If the attribution is the one of task complexity, then MS are called in order to proceed with the planning of the processes required or with the use of strategies.

Metacognitive judgments, on the other hand, can be product of nonconscious, heuristic, inferential, and attributional processes (Kahneman, 2003; Koriat & Levy-Sadot, 1999) or of analytic processes. In the former case, social cognition processes, such as judgment formation and judgment correction processes may play a role (Yzerbyt, Dardenne, & Leyens, 1998; Yzerbyt, Lories, & Dardenne, 1998). For example, we may use statistical inferences based on normative information, on individualized information regarding one's self or other persons, or on cues from one's or other persons' ME (e.g., use of feeling of confidence as a cue to infer ability). Social comparison processes or stereotypic knowledge can also be used to make judgments about one's own or others' cognition (Lories, Dardenne, & Yzerbyt, 1998; Salonen, Vauras, & Efklides, 2005).

To sum up, ME can be the product of a variety of different processes, most of which are nonconscious, nonanalytic ones. Moreover, metacognitive feelings have a hedonic quality that makes them unique, in the sense that they have access to processes of both the cognitive and the affective regulatory loop.

Metacognitive skills

Metacognitive skills (MS) constitute the control function of metacognition, that is, what the person deliberately does to control cognition (Veenman & Elshout, 1999). From this point of view, MS are related to volition, which has to do with action control and strategy use. The deliberate character of MS entails that the person consciously and purposively applies strategies, which ensure that his/her thinking will be in the desired direction and will bring about the outcome defined by the goal set. Brown (1978, 1987) called MS executive functions; however, the use of the term «metacognitive skills» denotes that they comprise strategies or procedural knowledge that is amenable to practice and automatization (Veenman & Elshout, 1999). Indeed, although MS when carried out consciously are effortful and pose demands on attentional resources, with extended practice they can get automatized with least demands on attention. Thus, the main difference between MK of strategies and MS is that the latter is procedural knowledge unlike MK, which is declarative.

Metacognitive skills comprise the following basic types of strategies:

(a) *Orientation strategies* that aim at making the task requirements explicit so that the person sets the proper goal(s) for task processing. They involve strategies such as asking oneself questions on the requirements of the task, on

comprehension, and on possible caveats, contradictions, and missing information that hinder understanding of the task. Going forth and back while reading the instructions, the material, or the data in order to form a coherent representation, is also a strategy often used. Other strategies, which are technical in nature but are used to facilitate orientation, are those that aim at making the representation of the problem space clear (Lompscher, 1999). They involve drawing of diagrams, use of symbols, producing tables, underlying the main ideas, and figuring out possible interrelations. Thus, the paths leading from the initial to the end state of the problem space are actively established.

(b) *Planning strategies* are those involved in the formation of a tentative sequence of higher-order processes, which in their turn will control the lower-order productions that are necessary for the processing of the task (Kreitler & Kreitler, 1987). Planning strategies can function at various levels of generality, ranging from an abstract overarching policy-specific level to the local level, which refers to the particular details for carrying out a specific action (Kreitler & Kreitler, 1987). Planning strategies may involve the establishment of subgoals and their sequence, the sequencing of procedures, the time schedule, the check points for monitoring the progress of the work done, etc.

(c) *Strategies for regulating cognitive processing.* These strategies are called in when the initial processing is not proceeding satisfactorily. They involve initiation and termination of cognitive processes, application of cognitive strategies, increase of effort, and time management (Nelson & Narens, 1994).

(d) *Strategies for checking (monitoring) the implementation of the planned action.* These are strategies that the person applies for the monitoring of cognitive processing vis-à-vis his/her plans (Veenman & Elshout, 1999). They involve monitoring of compliance to the planned sequence of processing and the time schedule that was set, detection of errors and/or delays of execution, detection of discrepancies between action and plan, checking the appropriate application of strategies or use of instruments, tools, etc. They also involve the identification of new needs that arise from the implementation of the plans, particularly if there is need for more input and revision of planning (Kuhn, 2000).

(e) *Strategies for the evaluation of the outcome of task processing.* Evaluation strategies involve appraisal of the outcome of the cognitive processing vis-à-vis previously established criteria or standards that pertain to the quality of it (Veenman & Elshout, 1999). They may also involve strategies for the evaluation of the quality of planning, regulation, and implementation of the strategies that were used to monitor task processing.

(f) *Strategies for recapitulation and self-regulation.* They involve strategies for the appraisal of the whole endeavour with a task, of what happened from the beginning to the end of processing, the strengths and weaknesses, the causes of the outcomes, and what should be attended to in the future (Schunck & Zimmerman, 1998).

Metacognitive skills can be applied as a predetermined component of the deliberately established course of action or can be activated when there is failure of the cognitive processing that demands control of the failed action, or when there are ME that denote lack of fluency of cognitive processing and call for control decisions.

Metacognition and self-regulated learning

At the beginning of this article I stressed the importance of self-regulated learning as a complex but integrated process, which involves cognition, motivation, affect, volition, and metacognition. Having metacognition as focal point, I showed that metacognition with its three facets contributes to self-regulation of learning through multiple pathways based on the monitoring and control of cognition. I shall now turn to the relations of metacognition with *motivation*. This aspect of metacognition is largely ignored, because the usual assumption is that motivation precedes cognitive processing and determines the direction of behavior and intensity of effort (Heckhausen, 1991). However, the decision to go on with task processing and to invest effort in it depends on the person's metacognitive awareness of task features, of task demands, of the person's ME regarding his/her interaction with the task and the situation. Thus, there can be motivation in the form of personality traits that operates before the person gets involved with a task, motivation due to the task and situational factors, and motivation during and after the person's involvement with the task. Metacognition can influence and/or interact with motivation at the situational level from the beginning of task processing to its end.

There are two ways in which metacognition can influence motivation, and through it, self-regulation of behavior. First, through its effects on self processes and, second, through its effects on causal attributions. Specifically, ME (such as feeling of difficulty, estimate of effort, feeling of confidence, and feeling of satisfaction) convey information about the self and the person's ability to successfully deal with a task. Metallidou and Efklides (2001) showed that ME predict the causal attributions made by students after problem solving. Feeling of confidence led to attributions of ability whereas feeling of difficulty to attributions of task difficulty and of ability. These ME also feed back on students' MK regarding the self as cognitive processor (or learner) and to the self-concept of ability in the domain in which the specific task belongs (Efklides & Dina, 2003, 2004; Efklides & Tsiora, 2002). Thus, the person's self-concept (including self-efficacy) is getting updated. Based on the updated self-concept the person builds his/her expectancies about his/her ability to meet the demands of new learning situations. Moreover, the person forms a personal «theory of learning», which refers to the self as learner. Such theory is based on the person's ME and MK formed in various learning situations, on learning outcomes, on the ways the difficulties were faced, and on the attributions about the causes of successes and failures.

Moreover, retrieval of ME formed in previous encounters with the same or similar tasks is activated by the task and/or its situational context, and these affective memories create an intrinsic context based on the quality of ME when involved in similar tasks in the past (Dermitzaki & Efklides, 2001). This implies that the person's mood state is affected and through mood the person's ME are also affected (Efklides & Petkaki, 2005), with an impact on the control decisions made. For example, if a student based on his/her ME and, possibly, on external feedback makes an attribution of lack of ability in a learning domain, then when s/he

comes across a task that belongs to this domain, even before starting processing the task, s/he will experience negative affect and form low expectations for success. As a consequence the student will try to avoid the task altogether or will seek help from others in a socially dependent manner. In this way the student does not make any effort to deal with the task but copies another person's response on this task. The result of this behavior is that the student does not gain any feedback from his/her ME as regards the specific task, and this has a number of implications.

First, the person's self-concept is not getting updated and any changes in his/her competences that might have occurred go unnoticed. Specifically, we have found that self-reports of feeling of difficulty before, during, and after problem solving usually differ based on how the student feels as s/he is solving the problem. Thus, feeling of difficulty at the end of processing may be similar, lower, or higher than the initial depending on the problem demands (Efklides, 2002a). This information leads to the differentiation of the student's self-concept according to the problem demands and the MK of the problem. However, for students who depend on, e.g., their classmates, to solve the problem, the feeling of difficulty remains the same regardless of the actual problem demands. This entails that they do not get feedback from their ME and they regulate their behavior based on a stereotypical conception of their ability in this learning domain.

Second, the person's initial negative affect remains unchanged and s/he does not get the reinforcement ensued by the decrease of feeling of difficulty as a result of his/her effort.

Third, the person does not feel confident with and satisfied from the outcome of the cognitive processing, and these ME further undermine his/her self-concept of competence in this learning domain and increase anxiety (Efklides & Dina, 2003, 2004).

Finally, another implication could be that the person in the long-term develops a performance-avoidance goal orientation, which further increases avoidance of self-monitoring. Indeed, Efklides and Dina (2007) found that mastery-oriented students were using more self-monitoring (in the sense that their ME correlated with task performance) than performance-approach-oriented students; the latter increased self-monitoring and calibrated their ME only in the case of negative (failure) external feedback. This finding probably suggests that performance-approach-oriented students used their ME as a point of reference to give meaning to the negative external feedback or to refute it if, for example, they felt confident about the correctness of the outcome of cognitive processing. On the other hand, mastery-oriented students were aware of their ME and their task performance regardless of the valence of the external feedback they received. However, performance-avoidance-oriented students did not seem to calibrate their ME in light of their performance or external feedback, because they either ignored their ME or were misinformed by them (e.g., they felt overconfident), and this led to unproductive control decisions that further increased the gap between their ME and task performance.

To sum up, ME contribute to the person's motivation through their effect on causal attributions, on self-concept, and possibly on achievement goal orientations. In this way, ME affect the long-term self-regulation process through motivation and the affective regulatory loop. On the other hand, they also affect the short-term self-regulation process through the changes of online affect that motivate control decisions. For example, overconfidence makes the person less perceptive of the situational demands, and more willing to engage with a new task. On the contrary, underconfidence increases the person's anxiety and may result in task avoidance, even if the person has the required competence. In other words, calibration of feelings of difficulty and confidence helps the person self-regulate effort according to task demands and meet the challenges of the situation.

Conclusion

Metacognition has been traditionally linked to the cognitive regulatory loop and is often conceived as conscious and deliberate. In this article I argued that metacognition has multiple facets, each one of them contributing to self-regulated learning in a different way. Thus, ME through the affective regulatory loop, which involves affect and motivation, contribute to both the short- and long-term self-regulation of effort and persistence; through the cognitive regulatory loop, which involves MK, MS, and ME such as metacognitive judgments/estimates and online MK, also contribute to the short- and long-term self-regulation of cognition. Also, MK, through implicit or explicit theories of cognition and theory of learning, contributes to the formation of expectancies and to the analysis of the cognitive features and demands of learning tasks and situations. Finally, MS, through strategic organization and procedural knowledge, control cognition and through it behavior.

The fact that metacognition often fails to control behavior cannot be reduced to simple lack of strategic knowledge or to nonuse of MS. It is the interaction of all the facets of metacognition that is important and, particularly, the motivation induced by ME that activates extant MK and/or MS.

Note

[1] Such models or representations of cognitive functions are often given with the prefix «meta» added to the name of the function: meta-language, meta-memory, meta-thinking…

References

Bartsch, K., & Wellman, H.M. (1995). *Children talk about the mind*. New York: Oxford University Press.

Brown, A.L. (1978). Knowing when, where and how to remember: A problem of metacognition. In R. Glaser (Ed.): *Advances in instructional psychology* (pp. 77-165). Hillsdale, NJ: Erlbaum.

Brown, A.L. (1987). Metacognition, executive control, self-regulated and other more mysterious mechanisms. In F. Weinert & R. Kluwe (Eds.): *Classroom management* (pp. 144-181). Hillsdale, NJ: Erlbaum.

Carver, C.S. (2003). Pleasure as a sign you can attend to something else: Placing positive feelings within a general model of affect. *Cognition and Emotion, 17,* 241-261.

Carver, C.S., & Scheier, M.F. (1998). *On the self-regulation of behavior*. Cambridge, UK: Cambridge University Press.

Deese, J., & Hulse, S.H. (1967). *The psychology of learning* (3rd. ed.). New York: McGraw-Hill.

Dermitzaki, I., & Efklides, A. (2001). Age and gender effects on students' evaluations regarding the self and task-related experiences in mathematics. In S. Volet & S. Jarvela (Eds.): *Motivation in learning contexts: Conceptual advances and methodological implications* (pp. 271-293). Amsterdam: Elsevier.

Efklides, A. (2001). Metacognitive experiences in problem solving: Metacognition, motivation and self-regulation. In A. Efklides, J. Kuhl & R.M. Sorrentino (Eds.): *Trends and prospects in motivation research* (pp. 297-323). Dordrecht, The Netherlands: Kluwer.

Efklides, A. (2002a). Feelings as subjective evaluations of cognitive processing: How reliable are they? *Psychology: The Journal of the Hellenic Psychological Society, 9*, 163-184.

Efklides, A. (2002b). The systemic nature of metacognitive experiences: Feelings, judgments and their interrelations. In M. Izaute, P. Chambres & P.-J. Marescaux (Eds.): *Metacognition: Process, function and use* (pp. 19-34). Dordrecht, The Netherlands: Kluwer.

Efklides, A. (2006). Metacognition and affect: What can metacognitive experiences tell us about the learning process? *Educational Research Review, 1,* 3-14.

Efklides, A., & Dina, F. (2003). Effects of extrinsic feedback on performance and affect: The role of metacognitive experiences. In A. Efklides, M. Tzouriadou & A. Leondari (Eds.): *Scientific Annals of the Psychological Society of Northern Greece: Vol. 1. Psychology and Education* (pp. 77-107). Athens: Ellinika Grammata.

Efklides, A., & Dina, F. (2004). Feedback from one's self and from the others: Their effect on affect. *Hellenic Journal of Psychology, 1,* 179-202.

Efklides, A., & Dina, F. (2007). Is mastery orientation always beneficial for learning? In F. Salili & R. Hoosain (Eds.): *Culture, motivation and learning: A multicultural perspective* (pp. 131-167). Greenwich, CT: Information Age Publishing.

Efklides, A., & Petkaki, C. (2005). Effects of mood on students' metacognitive experiences. *Learning and Instruction, 15,* 415-431.

Efklides, A., & Tsiora, A. (2002). Metacognitive experiences, self-concept and self-regulation. *Psychologia: An International Journal of Psychology in the Orient, 45,* 222-236.

Efklides, A., & Volet, S. (Guest Eds.) (2005). Feelings and emotions in the learning process [Special issue]. *Learning and Instruction, 15*(5).

Fabricius, W.V., & Schwanenflugel, P.J. (1994). The older child's theory of mind. In A. Demetriou & A. Efklides (Eds.): *Intelligence, mind and reasoning: Structure and development* (pp. 111-132). Amsterdam: Elsevier.

Flavell, J.H. (1976). Metacognitive aspects of problem solving. In L.B. Resnick (Ed.): *The nature of intelligence* (pp. 231-325). Hillsddale, NJ: Erlbaum.

Flavell, J.H. (1979). Metacognition and cognitive monitoring: A new area of cognitive developmental inquiry. *American Psychologist, 34,* 906-911.

Frijda, N. (1986). *The emotions*. Cambridge, UK: Cambridge University Press.

Harris, P. (1992). From simulation to folk psychology: The case for development. *Mind and Language, 7,* 120-144.

Heckhausen, H. (1991). *Motivation and action* (P. K. Leppmann, Trans.). Berlin: Springer.

Kahneman, D. (2003). A perspective on judgment and choice. *American Psychologist, 58,* 697-720.

Koriat, A., & Levy-Sadot, R. (1999). Processes underlying metacognitive judgments: Information-based and experience-based monitoring of one's own knowledge. In S. Chaiken & Y. Trope (Eds.): *Dual-process theories in social psychology* (pp. 483-502). New York: Guilford.

Kreitler, S., & Kreitler, H. (1987). Conceptions and processes of planning: The developmental perspective. In S.L. Friedman, E.K. Scholnick & R.R. Cocking (Eds.): *Blueprints for thinking: The role of planning in cognitive development* (pp. 205-272). New York: Cambridge University Press.

Kuhl, J. (1985). Volitional mediators of cognitive behavior consistency: Self-regulatory processes and action versus state orientation. In J. Kuhl & J. Beckman (Eds.): *Action control* (pp. 101-128). New York: Springer.

Kuhl, J. (2001). A functional approach to motivation: The role of goal enactment and self-regulation in current research on approach and avoidance. In A. Efklides, J. Kuhl & R.M. Sorrentino (Eds.): *Trends and prospects in motivation research* (pp. 239-268). Dordrecht, The Netherlands: Kluwer.

Kuhn, D. (2000). Theory of mind, metacognition and reasoning: A lifespan perspective. In P. Mitchell & K.J. Riggs (Eds.): *Children's reasoning and the mind* (pp. 301-326). Hove, UK: Psychology Press.

Lompscher, J. (1999). Learning activity and its formation: Ascending from the abstract to the concrete. In M. Hedergaard & J. Lompscher (Eds.): *Learning activity and development* (pp. 139-166). Oxford, England: Aarhus University Press.

Lories, G., Dardenne, B., & Yzerbyt, V.Y. (1998). From social cognition to metacognition. In V.Y. Yzerbyt, G. Lories & B. Dardenne (Eds.): *Metacognition: Cognitive and social dimensions* (pp. 1-15). London: Sage.

Metallidou, P., & Efklides, A. (2001). The effects of general success-related beliefs and specific metacognitive experiences on causal attributions. In A. Efklides, J. Kuhl & R.M. Sorrentino (Eds.): *Trends and prospects in motivation research* (pp. 325-347). Dordrecht, The Netherlands: Kluwer.

Nelson, T.O. (1996). Consciousness and metacognition. *American Psychologist, 51,* 102-116.

Nelson, T.O., Kruglanski, A.W., & Jost, J.T. (1998). Knowing thyself and others: Progress in metacognitive social psychology. In V.Y. Yzerbyt, G. Lories & B. Dardenne (Eds.): *Metacognition: Cognitive and social dimensions* (pp. 69-89). London: Sage.

Nelson, T.O., & Narens, L. (1994). Why investigate metacognition? In J. Metcalfe & A. Shimamura (Eds.): *Metacognition: Knowing about knowing* (pp. 1-25). Cambridge, MA: The MIT Press.

Newell, A. (1990). *Unified theories of cognition*. Cambridge, MA: Harvard University Press.

Pekrun, R., Elliot, A.J., & Maier, M.A. (2006). Achievement goals and discrete achievement emotions: A theoretical model and prospective test. *Journal of Educational Psychology, 98,* 583-597.

Pekrun, R., Goetz, T., Titz, W., & Perry, R.P. (2002). Academic emotions in students' self-regulated learning and achievement: A program of quantitative and qualitative research. *Educational Psychologist, 37,* 91-106.

Pribram, K.H. (1999). The self as me and I. *Consciousness and Cognition, 8,* 385-386.

Robinson, E. (1983). Metacognitive development. In S. Meadows (Ed.): *Developing thinking: Approaches to children's cognitive development* (pp. 106-141). London: Methuen.

Salonen, P., Vauras, M., & Efklides, A. (2005). Social interaction: What can it tell us about metacognition and co-regulation in learning? *European Psychologist, 10,* 199-208.

Schneider, W. (1985). Developmental trends in the metamemory - memory behavior relationship: An integrative review. In D.L. Forrest-Pressley, G.E. MacKinnon & T. Gary Waller (Eds.): *Metacognition, cognition and human performance: Vol. 1. Theoretical perspectives* (pp. 57-109). San Diego, CA: Academic.

Schunk, D.H., & Zimmerman, B.J. (Eds.). (1998). *Self-regulated learning: From teaching to self-reflective practice.* New York: Guilford.

Stuss, D.T., & Benson, D.F. (1986). *The frontal lobes* (2nd ed.). New York: Raven.

Veenman, M.V.J., & Elshout, J.J. (1999). Changes in the relation between cognitive and metacognitive skills during the acquisition of expertise. *European Journal of Psychology of Education, XIV,* 509-523.

Volet, S., & Järvelä, S. (Eds.) (2001). *Motivation in learning contexts: Conceptual advances and methodological implications.* Amsterdam: Elsevier.

Wellman, H.M. (1990). *The child's theory of mind.* Cambridge, MA: Bradford.

Yzerbyt, V.Y., Dardenne, B., & Leyens, J-Ph. (1998). Social judgeability concerns in impression formation. In V.Y. Yzerbyt, G. Lories & B. Dardenne (Eds.): *Metacognition: Cognitive and social dimensions* (pp. 126-156). London: Sage.

Yzerbyt, V.Y., Lories, G., & Dardenne, B. (Eds.) (1998). *Metacognition: Cognitive and social dimensions*. London: Sage.

Zimmerman, B.J. (1998). Developing self-fulfilling cycles of academic regulation: An analysis of exemplary instructional models. In D.H. Schunk & B.J. Zimmerman (Eds.): *Self-regulated learning: From teaching to self-reflective practice* (pp. 1-19). New York: Guilford.