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Self-regulated Learning at the Junction of Cognition and Motivation

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Self-regulated learning has emerged as a powerful new learning theory that is able to promote the transfer of knowledge and skills to real-life situations and make students more independent of their teachers in extending and updating their knowledge base. In recent years, many researchers have shown an interest in developing a theory of self-regulated learning. Considerable research has been generated, but the concept is still too broadly defined and its basic foundations remain poorly understood. The purpose of this paper is to examine the theoretical underpinnings of two strongly related aspects of self-regulated learning that have, until recently, been studied in a relatively isolated fashion. The conceptual framework that is presented in this paper highlights the parallel and reciprocal relationships between components of the cognitive and motivational repertoire and centers on three levels of these repertoires: domain-specific knowledge, strategy use, and goals.

Keywords: Cognition, Metacognition, Motivation, Control, Strategies.

Educational Psychology: A New Perspective

Studying Learning "in Context"

Wittrock (1992) argued that, traditionally, research in educational psychology has been conducted from two perspectives. Research set up from the first perspective is practice oriented, whereas research designed from the second perspective applies principles from general psychology in an attempt to understand the phenomena of learning and instruction. But, as Resnick (1987) explained, most educational psychologists no longer see their field as an application of mainstream psychology. They set up fundamental research on the processes of learning and instruction and conduct this research in actual classrooms, rather than in the psychological laboratory. The reason for this change in perspectives is that educational psychologists want to study learning processes "in context." They have come to realize that students' perceptions, cognitions, and actions are highly situated. This implies that students' conceptual structures and their cognitive strategies are influenced by the environment in which they have been acquired (see Boekaerts, 1995b; Mischell & Shoda, 1995). At the same time, it means that the social and cultural environment in which learning processes take place is reciprocally affected by students' actions.

By adopting the "situated learning" or contextual approach, educational psychologists changed their focus away from studying students' learning abilities and learning outcome to (1) students' capacity to regulate their own learning, and (2) to teachers' skills to create appropriate learning environments. This shift in research focus reflects the belief that learning is essentially a goal-directed process, and that how this process is described and explained will be closely tied to our understanding of what learning in different contexts entails. This new perspective on research in educational psychology challenged the traditional equilibrium between

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students and teachers, as actors in the teaching-learning process. Indeed, adequate teaching is no longer seen as transferring information to the learners' memory, and adequate learning is no longer equated with having high results in school examinations. Rather, many researchers currently defend the view that a major goal of formal education should be to equip students with self-regulatory skills. These skills are viewed as vital, not only to guide one's own learning during formal schooling, but also to educate oneself and up-date one's knowledge after leaving school. To this end, students should be motivated to actively participate in the teaching-learning process, constructing their own knowledge, and, in doing so, becoming gradually independent of their teachers. In parallel, teachers should create powerful learning environments in which students can learn to steer and direct their learning, control their effort expenditure, and manage their emotions. Together these aspects of learning have been referred to by the term "self-regulated learning" (see Pintrich, 1995).

Today, there is a general agreement among researchers that, in schools, most students are not learning by understanding, simply because many learning situations are suboptimal. For example, most teachers still believe that learning has been achieved when students can retrieve or use information sometime after it has been read, heard, or discussed. Also, they are convinced that knowledge which has been transmitted to students is easily accessible later on, and facilitates the acquisition of new knowledge. Yet it has become apparent that many students experience difficulties in applying the knowledge and skills acquired in the classroom to everyday situations.

The Cognition and Technology Group at Vanderbilt (1990) demonstrated that this is largely due to learning facts that are isolated from the contexts from which they derive meaning. They advocated that learning is a constructive and active process (see also Spiro, Feltovitch, Jacobson, & Coulson, 1991). Students not only perceive and appraise the new information, they actively construct it on the basis of activated prior knowledge. Constructive learning has been defined as a natural by-product of experiences encountered within contexts in which the-knowledge-to-be-learned is embedded in a natural way (Brown, Collins, & Duguid, 1989; De Corte, 1995).

Elsewhere, I have argued that the learning process of self-regulated learners is inherently constructive and goal-directed (Boekaerts, 1992, 1995 a, b). I made an attempt to describe the key dimensions of active, constructive learning in my hierarchical model of goal-directed learning, and showed that self-regulated learners rely on different types of prior knowledge, including:

- Domain-specific knowledge and skills,
- Cognitive strategies that can be applied to these domains,
- Metacognitive knowledge and skills, and
- Metamotivational knowledge and skills.

In previous papers, I gave a brief description of the basic constructs of goal-directed learning and the relationships between these constructs. However, no clear guidelines were provided to distinguish and foster cognitive, metacognitive, and motivational strategies. Yet, this information is essential to derive instructional implications from the hierarchy. It is the purpose of this paper to extend the model and to show the benefits of using the extended model in research on self-regulated learning.

Self-regulated Learning

As a construct, self-regulated learning (SRL) is difficult to define. Most researchers will agree that an essential aspect of SRL is its goal directedness. Other personal attributes that emphasize SRL have been identified, including a sense of self-efficacy, willingness to practice, commitment, time management, metacognitive awareness, and efficient strategy use. In contrast, personal attributes that have been associated with poor SRL and underachievement are impulsiveness, low academic goals, low self-efficacy, low control, and avoidance behavior (Borkowski & Thorp, 1994).

Although researchers and practitioners in educational psychology have actively pursued programs with SRL as a central concept, and a considerable number of results are available, the emerging picture is still rather complex. We are not yet in a position to describe the process through which SRL develops, and we are still largely ignorant as to why some students become willing and able to take responsibility for self-regulating their own learning, whereas others fail to do so. In the past decade, some research groups have invested a lot of energy in trying to unravel the mechanisms through which metacognitive knowledge and skills develop out of cognition. In doing so they put a heavy emphasis on the learning process per sé, and on the way students attempt to regulate their own learning. It was documented that students' domain-specific knowledge, their use of cognitive strategies, and self-regulation jointly influence academic learning to a considerable extent

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(Alexander & Judy, 1988; Weinstein & Mayer, 1986; Winne, 1995).

Many researchers and practitioners agree that self-regulated learners are students who are (meta)cognitively and (meta)motivationally aware of what they are doing and what needs to be done to successfully attain self-defined or set goals. Schunk and Zimmerman (1994) defined SRL as "the process whereby students activate and sustain cognitions, behaviors, and affects, which are systematically oriented toward attainment of their goals" (p. 309). Elsewhere, I defended the view (Boekaerts, 1995 a) that students who can regulate their own learning are those who have the capacity (1) to exert control over different dimensions of the learning process, including the selection, combination, and coordination of cognitive strategies in a context-sensitive way, and (2) to allocate resources to the different aspects of the learning process, without too much distortion of well-being.

At the descriptive level, researchers and teachers agree what is understood when they refer to self-regulated learners. Reviews, lectures, and articles often begin with a description of the performance of a self-regulated student (e. g., Winne, 1995). Zimmerman and Martinez-Pons (1988) demonstrated that teachers do not have difficulties in identifying self-regulated students. They can describe their attributes quite well, and contrast them to those of students who are less capable of regulating their learning. These attributes include effective strategy use, initiative, persistence, confidence, resourcefulness, self-reactivity to task performance outcomes. It was also reported that teachers' judgments of aspects of SRL were quite consistent with students' self-reports of their academic attributes (see, e. g., Weinstein & Mayer, 1986)

This agreement at the descriptive level between researchers, teachers, and students contrasts greatly with the explanatory level. Researchers have problems distinguishing the constructs used in SRL from those employed in more traditional cognitive theories, such as acquisition of knowledge and procedural skills, efficient strategy use, and transfer. Indeed, it is complicated to disentangle process variables and outcome variables, as the following example illustrates:

> A student teacher stated in her report that the second graders in the class she had taught became more self-regulative. After having read her report, her supervisor confronted her with the question: "How can you tell that these students became more self-regulative?" She responded that the students had become more skillful and more self-efficacious in the use of computational skills, mainly addition and substraction. Moreover, they could also apply these skills to solve context problems of the type: "Pete has five apples and he eats two, how many has he got left?" The supervisor remarked that she was inclined to disagree with this explanation. Granted, she had also observed that most students were able to solve the 3 context problems, but that by itself is no proof of SRL. She explained to her students that she had noticed that the problems given to the students were highly similar to the ones that they had practiced on "the-road-to-automaticity," and that such applications are like "smooth driving on the motorway on a sunday afternoon." Hardly any self-regulation is required to produce the desired learning outcome. A more compelling demonstration of SRL would, in her opinion, be that these students could use the computational skills to solve complex, or less similar, context problems. Such problems require that students generate solution strategies at the point of application, rather than activate and apply stored rules.

Another explanation for the obstinate nature of the construct of SRL is that it is situated at the junction of several research fields, and that researchers working in these different areas make use of widely different conceptual frameworks to describe and explain their results. As a consequence, many of the constructs overlap conceptually. Examples include self-regulation, (meta)cognition, conceptual change, (meta)motivation, control, volition, planning, and goal-directed behavior. This complicates communication across disciplinary divides and renders the process of comparing research findings and integrating them into a more comprehensive theory of SRL very difficult. Indeed, if researchers want to convince their fellow researchers who are currently conducting more traditional learning research that the SRL conceptual framework is superior, they have to be able to describe the underlying processes of SRL, even when that proves to be extremely difficult. In their retrospective on the different chapters in their edited book on SRL, Schunk and Zimmerman (1994) stated explicitly that the field of SRL would benefit from greater conceptual clarity.

Two Different Conceptual Frameworks

Research on two basic mechanisms of SRL, namely cognitive self-regulation and motivational self-regulation, has developed in a relatively isolated fashion. In my six-component model of SRL, I conceptualized two parallel, but strongly interrelated regulatory systems, namely the cognitive information processing system and the moti-

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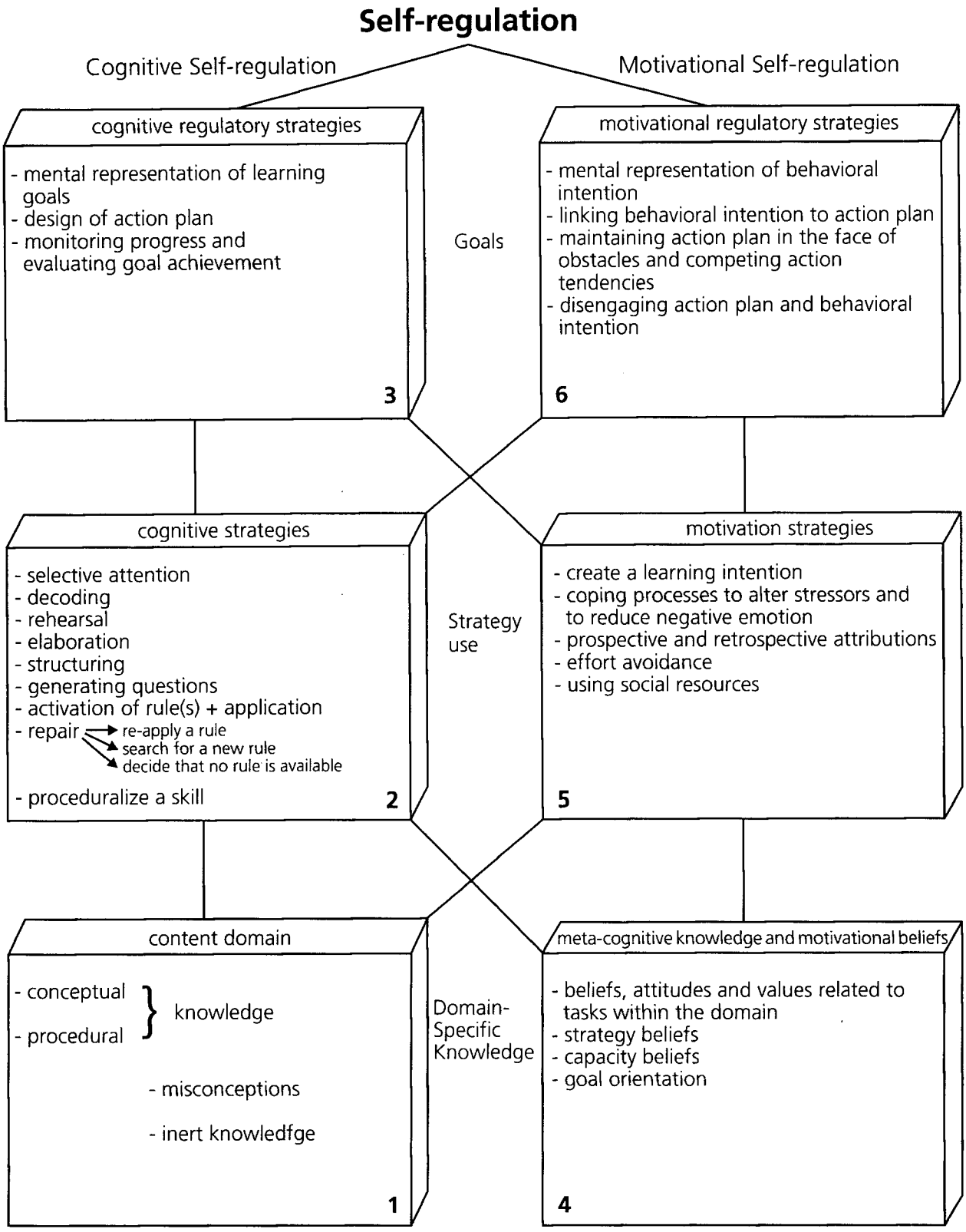

Figure 1. A six-component model of self-regulated learning.

vational-emotional system. Before presenting this model, let me address the complementary nature of cognitive and motivational regulatory strategies in students' attempts at SRL:

> Imagine a high school student, Theresa, who has to prepare for an important history exam. Theresa has some idea about the self-regulatory activities that will help her pass the exam. She begins by orienting herself on the type of material she has to study. She organizes the material in several meaningful sets, and allocates time to the study of each set, taking account of the quantity of the material in each set. Next, she begins reading through the material included in the first set, identifying the major points and writing them down in her scrap book. After reading through all the material included in the first set, she inspects the major points in her scrap book and tries to organize the material in such a way that she can easily revise it when she has completed the other sets. Sometimes she prefers to summarize the material in the form of a flow chart, a table or a diagram. At other times, she gives preference to a verbal summary, incorporating the examples the teacher gave in class, or the ones she picked up from television. When the material is conceptually clear, she saves time and effort by simply listing the major points in her own order. Theresa feels motivated to continue the learning activities, when she observes steady progress. At the point, when she detects some difficulty in mastering the material, she does not feel discouraged. Rather, she then attempts to represent the material in different ways, selecting the representation that she thinks will help her most when she has to review the material the day before the exam. When Theresa has the impression that she cannot master the learning material, which is often the case in mathematics and physics, she feels her anxiety mount. She is aware that feeling anxious has a negative effect on her motivation and will make her forget about self-regulation. Her teachers have recently coached her in self-regulation. Theresa now knows how to prepare for difficult exams, and she realizes that anxiety is part and parcel of such preparations for most of her fellow-students too. Now that she knows which actions to take, she feels less anxious for most school subjects. Also, she no longer seeks to reduce her anxiety while attempting to solve the problem that elicited it. Rather, she turns to an easier task or problem, making a mental note to revert to the problem that caused anxiety, when she has successfully completed the other task(s). In nonexam situations, she prefers to ask her fellow students how they handled the task, selecting from their strategies the one that seems most appropriate for her.

This example illustrates that cognitive and motivation strategies are intertwined aspects of self-regulation. A casual observer, or a researcher who is not familiar with the complementary models, may easily confuse these strategies. Moreover, they may not be aware that these strategies refer to different underlying mechanisms that have emerged from the interaction between different components of the self-regulating system. I will now describe the combined aspects of SRL as two sides of the same coin. One side of the coin refers to cognitive self-regulation, the other side to motivational self-regulation. I will use the six components visualized in Figure 1 as a reference point. This model differs from more common approaches in metacognition, motivation, and SRL in several ways. First, it consists of two parallel regulatory systems, as pictured in the left and right halves of Figure 1. Second, the different components of the cognitive and motivation repertoire are positioned at three interacting levels, namely the levels of domain-specific knowledge, strategy use, and goals. Third, it is assumed that prior knowledge located at each of these levels is differentially effective for new learning to occur. Conversely, various aspects of the overall learning experience are considered of differential importance in the elaboration and extension of prior knowledge described in each of the six components. It is important to note at this point that the six-component model of SRL is a heuristic device and not a summary of empirical findings, which at present would not entirely support such a structure. In the rest of this paper, the six components are defined and explained in separate sections. Nevertheless, they are designed to build upon one another in a complex, interacting manner. The intended result is a rich, coherent framework that, I hope, will be of considerable practical utility for guiding research and educational implementation.

Toward a Theory of Self-Regulated Learning

(Meta)cognitive Self-regulation: One Side of the Coin

The concept of metacognition (cognizing about cognition) can be dated back to Flavell's (1979) influential paper. Almost 10 years later, Brown (1987) argued that early metacognitive theories drew on four theoretical sources, stemming from widely different research lines,

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including psychological theories of executive control, theories of the use of verbal reports as data, the Piagetian theory of self-regulation, and the Vygotskian theory describing the shift of external regulation to self-regulation. Brown explained that it had proved difficult to integrate these conceptual frameworks into a comprehensive theory of metacognition and that this eventually led to a split of metacognition into a theory of mind and self-regulation. The former refers to the knowledge component. It entails information about the conditions of effective and ineffective strategy use with respect to specific tasks and content domains. The latter refers to the skill component; it involves various regulatory strategies including orienting, planning, monitoring, self-testing, and repair. Despite this split, many authors continued using the term metacognition in an overinclusive way, including multiple aspects of cognizing about cognition, learning, and behavior, as well as self-regulation. This broad-spectrum approach caused conceptual confusion in descriptive as well as intervention studies on SRL. In summary, highly varied forms of students' (meta)cognitive self-regulation have been studied in a wide range of educational settings. These research findings diverge in many ways, including their theoretical framework and methodology, but they share interesting similarities as well. Drawing on the available results, I suggest that competent metacognitive performance within a domain of study is characterized by the interaction of prior knowledge, located at different levels of the cognitive repertoire. This interaction is necessary to make an adequate representation of learning goals, generate (alternative) action plans, and select the most appropriate cognitive strategies in function of the learning goal, its context, and the available domain-specific information.

Component 1: Domain-Specific Knowledge and Skills

There is a vast body of literature documenting the beneficial effect of prior domain-specific knowledge on new learning (Dochy, 1996). Accumulating evidence indicates that learning is more domain-specific than originally conceived. For example, Shuell (1986) and Resnick (1987) showed that students learn better from direct experiences in concrete and authentic learning situations. In the same vein, Schneider, Körkel and Weinert (1988) showed that domain-specific knowledge has a stronger association with information-processing components in a specific subject-matter domain than general cognitive ability, and can even compensate for low overall aptitude. As can be seen from Figure 1, domain-specific knowledge entails conceptual and procedural knowledge. Several authors pointed out that not all new knowledge is learned in a purposeful and meaningful way. For example, Brown and Campione (1984) demonstrated that, in school, a lot of "inert" knowledge is acquired, which implies that students have not extended their conceptual knowledge base. The information they have newly acquired has been encapsulated, and it can not be retrieved unless an explicit cue to its activation is given.

Vosniadou (1992) provided evidence that students may have "entrenched beliefs" about reality which may obstruct the development of more valid conceptualizations. She collected data from students attending preschool, elementary school, high school, and college in different countries, including Greece, Samao, India, and the United States in order to understand the conceptual knowledge they have about astronomy. Vosniadou discovered that students construct different explanatory frameworks on the basis of their phenomenal experience. Radical restructuring of these intuitive models is often necessary, and this implies that students should have the capacity (components 2 and 3) and the inclination (components 4, 5, and 6) to question their intuitive beliefs, identify misconceptions, and replace them with a new explanatory framework that is more useful in explaining relevant empirical observations. The domain-specific restructuring view has received wide support from educational psychologists working in different content areas (for review, see Dochy, 1996). This evidence should not, however, be interpreted in the sense that all our knowledge is domain-specific. Alexander and Judy (1988) and Shuell (1986), for example, have argued that domain-specific knowledge is stored in memory alongside domain-transcending knowledge, and that both these forms are essential for learning to take place.

Component 2: Cognitive Strategies

Having access to and being able to reproduce declarative or procedural knowledge does not automatically imply understanding it. The point being made is that students may also have naive models at the level of cognitive strategies. For example, some students may use elaboration when they are prompted by explicit instruction, but feel at a loss when they have to extend or update their knowledge outside class. The reason for this failing may be that they are not aware of why, or when, they should use this cognitive strategy.

The term "cognitive strategy" is used to refer to cognitive processes and behavior that students use during

actual learning experiences to complete an assignment or to accomplish a goal implied by the academic task. Some of these strategies are performed automatically, whereas others are under the control of the learner. Different types of cognitive strategies have been discussed in the literature (see, e. g., Kirby, 1988; Weinstein and Mayer, 1986), including selective attention, rehearsal, elaboration, structuring, summarization, and generating questions. Some cognitive strategies have not received much attention in the literature on academic learning (e. g., decision making) while others have traditionally been listed with metacognitive strategies (e. g., repair).

Glaser, Lesgold, and Lajoie (1987) demonstrated that individuals who are expert in a specific domain of study are not only more accurate than novices, but that they are also more efficient in their strategy use. That is, they are able to select and combine strategies and to perform them in less time and with fewer steps than novices. All aspects of their information processing seem to be affected by prior conceptual knowledge (component 1) and by cognitive strategies that relate to that knowledge (component 2), such as awareness of and selective attention to cues in the physical and social environment, encoding and depth of processing of new information, activation of relevant stored information (cf. Alexander, Schallert, & Hare, 1991; Pintrich, Cross, Kozma, & McKeachie, 1986). In the same vein, Winne (1995) suggested that experts perform better than novices, because they have access to many proceduralized skills. Such skills refer to a set of cognitive strategies that are specifically adapted to fit the conceptual and procedural knowledge in a content domain and are ready to be used without much conscious control. He further assumed that running off such skills takes less cognitive resources than to consult multiple propositions, strung together by a declaratively encoded rule (component 1).

Research further indicated that students who have had strategy training are not inclined to continuously use the newly acquired strategies. They may automatically revert to old strategies, simply because they are more familiar to them. However, when deficits become obvious, or when they are prompted by the teacher, the text, or their peers, they may remember to use the new strategy. Hatano (1995) and De Corte (1995) indicated that teachers who want their students to use a newly acquired skill as a tool have to create learning environments in which students learn more about a domain by: (1) extending their conceptual knowledge, thus integrating old knowledge with new knowledge, and (2) developing better cognitive strategies to structure that knowledge and to work with it.

It is also noteworthy that cognitive strategies that have become part of a learner's habitual cognitive repertoire will not fit flawlessly in new learning situations. Learners must be able to detect this mismatch and adapt their cognitive strategies to new contexts. Salomon, Perkins, and Globerson (1991) pointed out that in order to take a strategy or skill from one domain to another, it is essential that students are mindful of the transfer. If students do not make a deliberate effort to transfer a strategy from one domain to another, it remains inert, or strictly bound to the context in which it has been acquired. Such context-bound strategies must be decontextualized or freed in order to be purposeful, and anchored to many feasible real-world contexts (cf. Brown, Collins, & Duguid, 1989; The Cognition and Technology Group at Vanderbilt, 1990).

Several authors argued that complex skills, embracing different cognitive strategies as well as self-regulatory strategies, are the result of long effortful accomplishment in a domain of study (e. g., Pressley, 1995), and that skilled performance continues to improve long after errorless performance has been achieved.

Component 3: Cognitive Self-regulatory Strategies

As students get older, the cognitive strategies in their repertoire increase in number, and become more tailored to everyday demands. This implies that they have access to many proceduralized skills, but also that they can take steps to adapt their cognitive strategies in situations where they detect a misfit between cognitive strategies activated from their cognitive repertoire and situational demands. In the past decade, such regulatory processes have been referred to with the term "metacognitive skills" and there is evidence that students who possess these skills have better grades (Zimmerman & Martinez-Pons, 1988). In my opinion, the conceptual distinction between cognitive strategies and metacognitive skills is still obscure, despite the fact that many different dimensions of metacognitive activity have been studied, and several successful training programs have been designed to foster metacognitive skills. Hence, there is a need for a clear conceptual distinction.

Indeed, most researchers who have studied metacognitive skills have focused on the strategic knowledge that students possess and have access to *when prompted*, and not on the skills students *actually use* to regulate their own learning. Thus, most of the results were obtained in a context where teachers formulated the learning goals, designed the curriculum, and prompted students to improve their learning. I would suggest, that a

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shift in emphasis is necessary. We ought to study students' capacity to assemble specific contents (component 1) and cognitive strategies (component 2) in a context-specific way, as well as their self-regulatory skills to adapt cognitive strategies when misfits occur (component 3). The point being made is that cognitive self-regulation is goal-directed behavior and should be studied as such.

Henceforth, I will use the term "cognitive self-regulatory strategies" to refer to cognitive processes and behavior that are especially geared toward accomplishing self-set (or adopted) goals, and toward regulating one's activities in order to accomplish these goals. Such regulatory strategies embrace three highly complex skills. The first skill refers to the student's capability to form a clear mental representation of the learning goal and to re-define it when necessary. The second denotes the capacity to device a plan of action and to extend or revise it, when appropriate. The third skill involves the ability to monitor one's behavior, to detect mismatches, and to determine progress toward the (learning) goal. Teachers do not always give their students the opportunity to practice these three intertwined self-regulatory skills. What they do most of the time is communicate one or more learning goals to their students (sometimes this stage is even omitted), provide an action plan, and monitor the students' progress. In such an externally regulated learning environment, their is not much room for self-regulation to develop.

In order to train cognitive regulatory skills, teachers should, at first, explicitly communicate the learning goals to their students, prompting them to make a mental representation of these goals. Also, they should check whether the adopted goal is identical to the one that was communicated. For example, when the instruction is to comprehend the information in foreign language text, students may look up the new words in a dictionary in order to grasp the meaning of the text. They may not, however, make any deliberate attempt to learn the new words, since their learning goal was "comprehension" and not "acquisition of new words." Likewise, when teachers expect students to learn from their direct experiences during groupwork, they should communicate to the students what the learning goals are, including socially oriented goals, and make sure that the students have access to (or can design) a plan of action to attain the goals.

Designing an action plan signifies that students can reflect on the nature of the learning goal, in terms of the assembling of content (component 1) and cognitive strategies (component 2). When proceduralized skills are not readily available, they should orient themselves on the types of cognitive strategies that are necessary and sufficient to reach the goal. For example, most students know that reading an informative text requires a different action plan than reading a narrative text. They should use this knowledge (component 4) to design an action plan, and this involves decision making, a cognitive strategy that has been heavily neglected in the school curriculum.

Goal-oriented behavior also necessitates monitoring. Students should realize that the learning process is not an event, but an unfolding process. The action plan that they initially designed may not be adequate, because task demands or personal resources were under- or overestimated. Monitoring entails the ability to evaluate the strength and weakness of one's action plan as the learning process unfolds, replacing or extending the cognitive strategies that prove to be inadequate. Space does not permit to elaborate on these important aspects of SRL. The interested reader is referred to Pintrich (1995).

(Meta)Motivational Self-regulation: The Other Side of the Coin

Let us now turn the coin and look at motivational self-regulation. Several authors have pointed out that students can be expected to demonstrate SRL within a specific domain only when they have worked in learning environments where they applied both metacognitive and motivational knowledge and skills. In their recent book *Self-regulation of learning and performance*, Schunk and Zimmerman (1994) argued that the construct of SRL is reciprocally related to motivation. They defined the former construct as "the process whereby students activate and sustain cognitions, behaviors, and affects, which are systematically oriented toward attainment of their goals," and the latter as "the process whereby goal-directed activities are instigated and sustained" (p. 309). They notified that researchers need to be sensitive to distinctions among these two constructs as well as pay heed to their interdependence.

I hope that the distinction I have made between the three levels of cognitive self-regulation and the three levels of motivational self-regulation will be helpful in comparing and contrasting these related phenomena. In my opinion, cognitive self-regulation refers to the regulation of the learning process per sé, whereas motivational self-regulation has to do with other aspects of behavior, such as inclination, sensitivity, choice, level and time of involvement, and effort expenditure.

Researchers working within the motivational framework have introduced many overlapping constructs that refer to the knowledge that students have about themselves and about tasks, assignments, and learning situations. These models include the attribution theory (e. g., Weiner, 1986), achievement motivation (e. g., Heckhausen, 1980), intrinsic motivation (e. g., Deci & Ryan, 1985), goal orientation (e. g., Nicholls, 1984), and self-efficacy theory (e. g., Bandura, 1993). It is extremely difficult to discern the underlying mechanism of some motivational constructs. Broad as they are, some of these constructs encompass the self-beliefs that a student has, as well as their goals and plans of action. Such conceptualizations make it extremely difficult to study the separate and joint effects of students' beliefs and strategy use on actual performance and achievement. In analogy to the description of cognitive self-regulation, I found it useful to cast motivational self-regulation into three levels (see Figure 1).

Component 4: Motivational Beliefs and Theory of Mind

It has become evident that learning builds upon theories of mind and theories of self. Such theories pervade the process through the interaction of person variables with specific learning situations and subject-matter domains. It is important to note that at a specific moment in time only a subset of these theories is active, thus influencing the learning process. In Figure 1, a domain-specific subset is visualized. As can be seen, this subset includes (1) beliefs, attitudes, and values related to curricular tasks and subject-matter areas, (2) strategy beliefs related to a domain, (3) beliefs, judgments, and values related to one's capacity in relation to a domain of study, and (4) goal orientations (for more information, see Boekaerts, 1995 a; Pintrich, Marx, & Boyle, 1993). Examples of the first category are "I do not like history because you have to learn facts, dates and stories by heart," or "I am interested in history because you learn about the way people lived and behaved at different times." These self-referenced cognitions reflect students' beliefs and values in relation to a domain (attitudes, interest in content, procedures, and strategies), as well as past and future selves in relation to that content area.

The second category involves beliefs or knowledge about what it takes to do well in a particular content domain, and about the causes of success and failure in that domain. These self-referential cognitions involve the students' subjective knowledge (often referred to as "metacognitive knowledge" or "theory of mind"), as it relates to cognitive strategies used in relation to a particular subject-matter area (components 1 and 2), as well as his or her subjective knowledge about motivation strategies, including effort expenditure and access to social support (component 5). Examples of such self-referenced cognitions are: "In order to be a good reader you must be able to swiftly summarize the material read and have a good memory" or "If you do not spend more than an hour [or another indication of effort] on such a task, your score will be low."

The third category may include strategy beliefs, but also mere judgments about one's own capacity. Examples are: "I am no good in mathematics, since I always feel anxious when doing math exams" (capacity in relation to a skill situated in component 5), "I do not have the skill to learn a foreign language properly, since I cannot recall grammatical rules" (capacity in relation to a skill located in component 2), "You will never be able to work on your own because you cannot design a plan of action" (capacity in relation to component 3), "John is unable to finish a task because he is too volatile" (capacity judgment in relation to component 6).

Despite the wide variety of constructs and theoretical models, there is wide agreement that self-referenced cognitions, particularly perceived control, can be seen as strong motivators or inhibitors of behavior in general, and learning in particular (Bandura, 1993; Boekaerts, 1995 a; Schunk & Zimmerman, 1994). They influence the students' appraisals, and their cognitive and motivational self-regulation, by giving meaning and valence to learning tasks and situations.

Component 5: Motivation Strategies

Research has indicated that students who are interested in the contents, are intrinsically motivated, or feel comfortable in a learning situation are prepared to expend more effort than students who feel uncomfortable, or are anxious, sad, or extrinsically motivated. The former types of students seem to have the capacity to elicit positive cognitions and emotions with respect to a task or learning activity in actual learning situations, whereas the latter types of students lack this capacity. Some would consider these affectively laden processes personality traits, albeit transient ones. Elsewhere (Boekaerts, 1995 a), I made a distinction between personality traits that represent students' inclination to engage in scholastic learning, and students' selective sensitivity, or momentary readiness, to specific learning situations. I assumed that selective sensitivity, mindfulness, and willingness to do what is necessary to achieve mastery, complete a learning task, or accomplish a learning goal

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would be the outcome of motivation *strategies* applied in actual learning situations. Hence, I introduced the term "motivation strategies," in analogy to cognitive strategies.

In Figure 1, motivation strategies are located at the same level as cognitive strategies (component 5). This position symbolizes how motivation strategies operate directly on knowledge at the domain-specific level (component 4), and at the same time act as a repertoire of strategies from which students can select one or more strategies and adapt them in a context-sensitive way (link with component 6). Hence, motivation strategies should not be equated with beliefs about possible actions and control within a specific content area (mental connection between actions and outcomes). Instead, component 5 consists of a combination of skills that operate on the content of component 4. Like cognitive strategies, motivation strategies are used by students during actual learning experiences. Unlike cognitive strategies, they are not concerned with processing the content of the learning process, but are considered to be attempts on the part of the student to produce favorable states of mind and positive outcomes, or prevent undesired events and unfavorable outcomes. In parallel to cognitive strategies, motivation strategies may also be automatic or under the control of the learner.

Different types of motivational strategies have been discussed in the literature, including appraisal processes to create a learning intention (Boekaerts, 1995 a; Seegers & Boekaerts, 1993), prospective and retrospective attributions (Weiner, 1986), effort avoidance (Rollett, 1987), and coping strategies to alter stressors and to reduce negative emotions (e.g., danger control, anxiety control, see Boekaerts, 1995 c for review). Existing data reveal that motivation strategies can be either domain-specific or domain-transcending (Pintrich, Garcia, & De Groot, 1994). Furthermore, just like the other components of the model of SRL, students may have naive models at the level of motivation strategies. For example, some students may be highly motivated to start a learning activity when it is associated with fun, pleasant outcomes, or rewards. When the same students are faced with complex, ambiguous, or solo tasks, they may not want to expend much effort. What they then need (and often get) to boost their motivation is some form of external regulation. The teacher or a parent prompts them to put in more effort, and courts or coaxes them to work (Corno, 1995).

Several authors (see Boekaerts, 1994; Boggiano et al., 1989; Corno, 1995; Patrick, Skinner, & Connell, 1993; Weinert, Schrader, & Helmke, 1989) have propounded the view that external control limits the possibility of developing motivational awareness and motivational regulatory strategies. They argued that in situations where external control or social pressure is not present, as in homework situations or where students are offered a choice between working on an assignment or doing something else, volition control is revealed. In such choice situations, there is a logical need to regulate one's motivation.

Component 6: Motivational Self-regulatory Strategies

As students grow older, it is assumed that the motivation strategies in their repertoire become more differentiated. They will have encountered misfits between their motivation strategies and situational demands, and have come across situations where there was minimal or maximal external control. Negative feelings may have been elicited in these situations (see Patrick, Skinner, & Connell, 1993).

The point being made here is that the extent to which students close skill-demand gaps depends not only on their ability to amend shortcomings, but also on their willingness to use their resources to bridge these gaps. In other words, the students' ability to accomplish learning goals (components 1, 2, 3) should be distinguished from their *willingness* to use their personal resources (components 4, 5) and their capacity to execute their intentions (component 6). Kuhl (1984, 1994) used the term "action control" to refer to the skill to form a behavioral intention, and to the capacity to protect it from competing action tendencies till a goal is accomplished.

In earlier publications, I used the term "metamotivational skills" to refer to these skills, but, in order to ensure conceptual clarity, I shall henceforth call these skills "motivational self-regulatory strategies." They embrace at least four highly complex skills. The first skill refers to the student's capability to form a clear mental representation of his or her behavioral intention. Kuhl (1994) explained that individuals who confound their own goal-related beliefs with those of others will predominantly behave according to an external control pattern, encoding the wishes and expectations of others as obligations. Students who do not have access to motivational self-regulatory skills are characterized by a rigid, context-insensitive reliance on the goals, standards, wishes, and expectations of others. Such "other-related" commitments induce cognitions, emotions, and affects that are counterproductive for self-regulation. The second skill refers to the capacity to link a behavioral inten-

tion (component 6) to a plan of action (outcome of component 3) involving the chosen cognitive and motivation strategies. The third skill involves the ability to monitor one's behavioral intention, protecting and enacting it once it has taken shape, and allocating resources (time and effort) to the different aspects of the learning process, without too much distortion of well-being. Kuhl (1984, 1994) revealed debilitating effects on individuals' volitional abilities to plan, initiate, and complete intended actions. Volet (in press) and Boekaerts (1994) have illuminated the links between motivation strategies and motivational regulatory strategies. They demonstrated that the effort expended on a task or course is jointly determined by action control (component 6) and the skill to elicit positive appraisals before starting with a task or course (component 5).

Conclusions and Implications for Teaching

In the literature on learning and instruction there is frequent reference to the potential of SRL to serve as a vehicle for promoting the transfer of knowledge and skills to real-life situations, and for making students independent of their teachers in extending and updating their knowledge base. Despite the fact that considerable research has been generated, the foundations of SRL remain poorly understood. I argued that the field is in need of greater conceptual clarity and proposed my heuristic model of SRL. It highlights the parallel and reciprocal relationships between components of the cognitive and motivational repertoire and centers on three levels of these repertoires: domain-specific knowledge, strategy use, and goals.

In examining the theoretical bases of cognitive and motivational self-regulation, it became evident that SRL consists of several types of prior knowledge, and that awareness of and access to this knowledge, as well as the capacity to extend it on the basis of direct and indirect experiences, are key elements of SRL. There is also increasing evidence that motivational self-regulation operates in concert with cognitive self-regulation and influences effort allocation, performance, and achievement. However, more longitudinal research is needed to unravel the intricate relations between cognitive and motivational self-regulation and various outcome variables. I hope that the six-component model of SRL that I proposed in this paper will inspire researchers to meet this challenge.

In the meantime, educators should be aware that in classrooms, where the teacher is steering and guiding the learning process, students do not have much need for cognitive or motivational self-regulatory skills. What they are expected to do most of the time is to *apply* knowledge that the teacher has presented, has made available, or has advised them to use. Under such conditions, there is not much opportunity to represent goals and behavioral intentions, and neither is there a need to experiment with alternative cognitive and motivation strategies. In other words, most tasks set to students in formal schooling can be characterized as "outcome-based accomplishments" in which there is no logical need for experimenting with and reflecting on new strategies. Indeed, after having followed adequate instruction, most students will be successful in activating or generating the cognitive strategies that will produce a satisfactory solution in the time allotted by the teacher. Yet students must learn to rely on SRL in situations where the activated cognitive strategies fail to yield a satisfactory next step, and they should have faith in their motivational regulatory strategies when they are learning solo. A fully developed componential model of SRL should explicate the links between the various components of the model, and also describe how they build upon one another. It is for future research to specify these relations.

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