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METACOGNITIVE COMPONENTS IN LEARNING TO LEARN APPROACHES

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Abstract. ***Background.*** Numerous students are having school difficulties linked to the way they learn. Some people speak of a "metacognitive deficit". We refer to a "sleeping potential" instead. Be it psychologists, teachers or parents, all wish to develop their skills in order to help these students. This is the case in primary and secondary school. The EDUCA + project is intended to provide possible solutions. ***Purpose.*** The aim of this paper is to present a metacognitive and cognitive theory of learning to learn, which will (a) explain why numerous students are having school difficulties, and (b) predict the success of the EDUCA + project.

Keywords: metacognition, school, student, potential, dynamic assessment.

CONTEXT

The demand for clinical consultations concerning learning difficulties is increasing steadily. At the present time, numerous field workers are concerned about the fate of students with learning difficulties and/or experiencing school failure or even school dropout. Of course, this is not new. Several causes have been mentioned: the transition from primary to secondary school (Bronselaer, 2010; Hirrt, 2004), a cognitive deficit (Aubret, Blanchard & Sontag, 2006; Giasson, 2005; OCDE, 2011) or a metacognitive deficit (Grangeat, 1999; Lumbelli, 2001; Poissant, Poëllhuber & Falardeau, 1994; Rozencwajg, 2003). More or less successful initiatives emerged here and there. However, one has to admit that the psycho-pedagogical teams are most often helpless when facing these field realities as they lack tools and expertise.

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Studies show high rates of school failure, mostly in secondary school (*i.e.*, repeating in secondary school: from 7 to 20.8%). The transition years are said to be the most problematic. Thus in the first year of secondary school, 17% of the students repeat their year (against 7% in the first year of primary school), (AGERS, 2009). This primary/secondary school transition is a key-stage which can bring about new difficulties at school for the pupil (*e.g.*, distance from home, numerous teachers, stricter schedules, necessity for personal organization skills). However, this alone does not entirely explain these learners' difficulties (Vianin, 2009).

"… He failed in many subjects … She has learning difficulties … He has no strategy … Her learning methods are inadequate … He does not know how to learn … She is badly organized … She always does things at the last minute … He is not autonomous …". These are all adults' comments regarding the above-mentioned children and teenagers. In fact, their common feature is, generally, that they have what we can call a "sleeping potential". It means that the student does not use his/her learning potential fully and has not fully developed his/her metacognitive abilities.

THEORETICAL BACKGROUND

Introduction

Metacognitive abilities play a central role in learning (*e.g.*, Frenkel & Deforge, in press; Giasson, 2001; Grangeat, 1999; Hessels & Hessels-Schlatter, 2010; Lumbelli, 2003; Poissant et al., 1994; Rozencwajg, 2003; Veenman, Kok & Blöte, 2005) and thus in successful school learning (Büchel, 2013a, 2013b; Van der Stel & Veenman, 2010; Wang, Haertel & Walberg, 1994). However, studying them requires that we clarify what is meant by "metacognition" and "metacognitive abilities".

The term «metacognition» has been defined in various ways. These definitions show several components without any consensus being reached concerning their nature and number (Anderson, Nashon & Thomas, 2009; Livingston, 1997; Noël, 1997; Veenman, Hout-Wolters & Afflerbach, 2006; Vianin, 2009). They use heterogeneous terms, leading numerous authors to consider the concept as «fuzzy» (*e.g.*, Akturk & Sahin, 2011; Brown, 1987; Hacker, 1998).

Metacognition is defined by Flavell as «one's knowledge concerning one's own cognitive processes and outcomes or anything related to them (…) The active monitoring and consequent regulation and orchestration of these processes in relation to the cognitive objects or data on which they bear, usually in the service of some concrete goal or objective» (Flavell, 1976, p. 232) and more globally as a «cognition about cognitive phenomena» (Flavell, 1979, p. 906). These two aspects of knowledge and control (we will refer to them later) are found in the definitions proposed by Brown (1987[2]), Efklides (2001) and Noël (1997); the last two referring to the model of Nelson and Narens (1990).

Although there seems to be general agreement on these two aspects of (a) knowledge about cognition and (b) mechanisms of regulation in the definition of metacognition, their link with the psycho-affective variants at stake in learning is only of recent interest (see Berger & Büchel, 2012 for more details). Thus, although the interdependence between motivational beliefs and metacognition was reported as early as in the 1970s (*e.g.*, Brown, 1978), the reciprocal influence of these variants was only recently considered and studied in the field we are interested in. This was the case notably in the framework of the self-regulated learning theories.

Two main components emerged from the first works carried out by Flavell and Brown (and their respective teams): *metacognitive knowledge* and *metacognitive strategies*. Considering other works on metacognition leads us to lay emphasis on a third component: *metacognitive experiences*.

Metacognitive Knowledge

Metacognitive knowledge is defined as part of our knowledge about the world which has a relationship with individuals as cognitive beings and with their various aims, tasks, actions and cognitive experiences (Flavell, 1979). Three major categories were distinguished: person, task and strategy. Most metacognitive knowledge results from the interaction or combination among two or three of these categories.

In the 1990s, Paris and Winograd (1990a, 1990b) dealt with metacognitive knowledge via the notion of *self-appraisal*. This notion

[2] This double aspect of metacognition was already present in Baker & Brown (1980).

includes personal reflections about the state of one's knowledge and abilities. The authors distinguish the declarative type of knowledge (What you know), procedural type (How you think) or conditional type (When and why to apply knowledge and strategies). This allows us to know what we know, to know how we know it, and to know why and when to use this knowledge or apply the strategies (Jacobs & Paris, 1987; Paris, Lipson & Wixson, 1983)[3]. This categorization of metacognitive knowledge was also mentioned by Schraw and Moshman (1995) then Pintrich, Wolters and Baxters (2000). The latter included it in the category of metacognitive knowledge related to Flavell's strategies (1979). The authors then postulate the existence of metacognitive knowledge (a) of self, (b) of tasks and contexts and (c) of cognition and cognitive strategies; subdividing the last category into declarative, procedural, and conditional knowledge.

The distinction between the three categories proposed by Flavell (1979) can also be found in the works of Büchel and other members of his team (*e.g.*, Büchel, 1996; Büchel, Berger & Kipfer, 2011). In the field of self-regulated learning theories, Berger and Büchel (2013), among others, specify this by including too-often forgotten psycho-affective aspects in the global approach of learning. They distinguish knowledge relating to oneself (our motivation, emotions, and cognition), relating to the type of task (pre-knowledge of contents, level of difficulty of contents and reasons for the level of difficulty) and relating to cognitive and metacognitive strategies. According to these authors, it is not necessary to subdivide the last category, nor to postulate metacognitive knowledge of the conditional type. They consider that a strategy is, by definition, procedural and that a procedure includes the conditions necessary for its own implementation (Büchel, 1991).

This last conception allows us to account for the interrelation between cognitive, metacognitive, and psycho-affective aspects in

[3] If we take the example of cumulative rehearsal: (a) I know that this strategy is useful for me in order to memorize a word list (declarative knowledge), (b) I know that, in order to use it, I have to do so as early as the first word and that, practically, I repeat the word I have just heard after those I heard previously (procedural knowledge) and (c) I know that this strategy is adapted to an auditory presentation of words, that it is only useful if the list contains a limited number of words and that, if the list is too long, I will have to give it up and use another one (conditional knowledge).

learning and thus in the building of metacognitive knowledge. Moreover, it provides an operational grid for the identification and development of the learner's metacognitive knowledge.

Metacognitive Strategies

Metacognitive strategies are defined as activities used to regulate and oversee learning (Brown, 1987). These self-regulatory mechanisms are put into place while performing a task by individuals we will name «active learners» (Baker & Brown, 1980; Campione, Brown & Ferrara, 1982).

Brown (1987) was one of the first to mention metacognitive strategies under the term of *activities used to regulate learning*. From his viewpoint, these strategies refer to *planning* activities (predicting outcomes, scheduling strategies…), *monitoring* activities (monitoring, testing, revising and re-scheduling one's strategies for learning) and *checking* outcomes (evaluating the outcome of any strategic actions compared with criteria of efficiency).

Paris and Winograd (1990a, 1990b) also refer to metacognitive strategies via the term *self-management*. They define that term by specifying that it concerns metacognition in action and how metacognition can orchestrate cognitive aspects of problem solving. They distinguish *planning* (selective coordination of cognitive means in order to reach a cognitive goal), *evaluation* (evaluation of the unfolding of cognition while performing the task) and *regulating* (progress monitoring, revision and/or modification of plans and strategies used depending on the results), (Jacobs & Paris, 1987).

Although they use different terms (*activities*, *process vs. metacognitive strategies*), more recent conceptions – dating from the 2000s – agree on the presence of *planning*, of a form of *continuing control* (sometimes called *guidance*, *supervision* or *regulation* which allows constant checking and adjustments, if necessary) and a *final control* carried out at the end of a task and which bears on the results obtained (Büchel, 2001, 2007; Büchel et al., 2011; Martin, Doudin & Albanèse, 2001; Vianin, 2009). Even if we can find this forecast aspect in Martin et al. (2001), when they refer to the "expectations of results obtained", only Vianin (2009) and Büchel *et al* explicitly mention *anticipation*. *Transfer* allows generalization in

the sense of the implementation of knowledge and skills acquired to another context than that in which the acquisition took place. It is present in the conceptions of Martin et al. (2001) and of Vianin (2009). In Büchel *et al*.'s conception, transfer is not considered as a metacognitive strategy (Büchel 2007, 2013a, 2013b; Büchel et al., 2011).

In our work, we consider metacognitive strategies as self-regulatory mechanisms of cognitive functioning. These are general strategies intervening in all «problem-solving situations», in the term's largest conception. It groups school learning and vocational training situations, ordinary professional situations, or situations of daily life and hobbies. *Anticipation* and *planning* are meant as strategies of preparation of learning. *Continuing control* and *evaluation* (*i. e.*, *final control*) are strategies of supervision of learning. Regarding *transfer* (*i.e.*, generalization), there is a general consensus to admit that it allows to generalize knowledge, know-how and soft skills inside a field, and, on the other hand, in other fields. In this sense and through its interrelations with *anticipation*, *transfer* also allows to regulate cognitive functioning. However, it is not because it regulates cognitive functioning that it is *de facto* a metacognitive strategy. Of course, preparation for the transfer of strategies is one of the didactic aspects in metacognition teaching (Büchel, 1990).

Metacognitive Experiences

Thanks to the model of Nelson and Narens (1990), the interest also focused on a third component of metacognition: *monitoring* (which led us to reconsider metacognitive experiences). According to these authors, thanks to *monitoring* – and through a flow of information going back to it – the meta-level is informed by the object-level of the unfolding of the cognitive process. The authors distinguish two kinds of monitoring they make operational through different *metacognitive judgments* formed by the learner. These *metacognitive judgments* are the expression of introspective reports done by the learner in relation to his/her learning (cf. Léonesio & Nelson, 1990; Nelson & Narens, 1990, 1994 for more details).

Notably basing himself on this model, Noël (1997) distinguishes three stages in metacognition: *mental process* (which includes, among

others things, the learner's conscience of cognitive activities he carries out or their product), *judgment* (which bears on the cognitive activity or on the mental product of this activity) and *decision* (which can be to modify or not the cognitive activities, their product or any other aspect of the situation depending on the *metacognitive judgment* formed. This last step can lead the learner to undertake one or several regulatory actions of his/her cognitive activity.

These two aspects of the *mental process* (Noël, 1997) and *metacognitive judgment* (Nelson & Narens, 1990; Noël, 1997) refer, on the one hand, to the earliest definition of the *metacognitive experiences* of Flavell (1979) and, on the other hand, to those recently proposed by Efklides and by Büchel and other members of his team. The latter have explicitly introduced the implication and influence of psycho-affective factors on the metacognitive elements (laying an emphasis on motivational factors). These experiences are named "metacognitive" in the sense that they are the product of a cognition monitoring process (Efklides, 2001).

Efklides (2008, p. 279) defined metacognitive experiences as being "what the person is aware of and what she or he feels when coming across a task and processing the information related to it". In this conception, it refers to an online awareness when given a task; the metacognitive experiences then acting as an interface between the learner and the task (Efklides, 2006). They can thus manifest themselves before, while, or after the task is processed and they influence causal attributions of the person (Metallidou & Efklides, 2001). On this basis, Efklides proposed two categorizations of metacognitive experiences. The first makes a distinction between *metacognitive feelings*, *metacognitive judgments* and *online task specific knowledge*, (cf. Efklides, 2006 for more details). The second categorization lays on the three main phases of task processing. It leads the author to distinguish metacognitive experiences in relation with *task representation*, *cognitive processing*, and *performance* (cf. Efklides, 2011 for more details). It evokes the three functional loops defined by Feuerstein, Rand, Hoffman and Miller (1980) whose efficiency will enable the automation of knowledge and know-how: *input* (exploration and information intake), *elaboration* (mobilization of knowledge stocked in long-term memory) and *output* (control of actions' implementation).

Very recently, Berger and Büchel (2012, p. 96) defined metacognitive experiences as being «subjective feelings and judgments relating to the learner's «present» cognitive undertaking (which is the one taking place during the task); they are the interface between the learner and the task». Thus they make the link between cognition, motivation and feelings (Büchel, 2013b). Metacognitive experiences play a central role in cognitive functioning and in self-regulated capacities. We will come back to this point further in this paper.

METACOGNITIVE AND COGNITIVE THEORY OF LEARNING TO LEARN

Interrelations between Metacognitive Components

In order to shed light on the essential role played by the three main components of metacognition, our study is based, among other sources, on works previously mentioned and more particularly those of Büchel and other members of his team (*e.g.*, Büchel, 2007, 2013a; Büchel & Büchel, 2009). In this perspective, *metacognitive knowledge* is at the basis of *metacognitive strategies* which lead and co-ordinate (and thus trigger) *cognitive strategies* as well as cognitive processes (Figure 1). Indeed, in order to be efficient and to use the specific strategies needed to solve a problem efficiently, it is necessary for the student to anticipate the task difficulties, plan his/her strategy and check its implementation (Büchel, 1995). Learners use a strategy because they know that it will help them to reach their goal (metacognitive knowledge), therefore they plan to use this strategy (metacognitive strategy) and implement it in a concrete way (cognitive strategy).

Before implementing *metacognitive knowledge* and *metacognitive strategies*, one has to have acquired them. Indeed, these metacognitive abilities are not innate and have to be learned (*e.g.*, Klein, 1991; Vianin, 2009). In order to do that, the learner must have had the opportunity to acquire and practice them. In this way, environment[1] has to be an incentive and provoke metacognitive experiences. One of its roles is to

[1] The term is used here in its largest meaning.

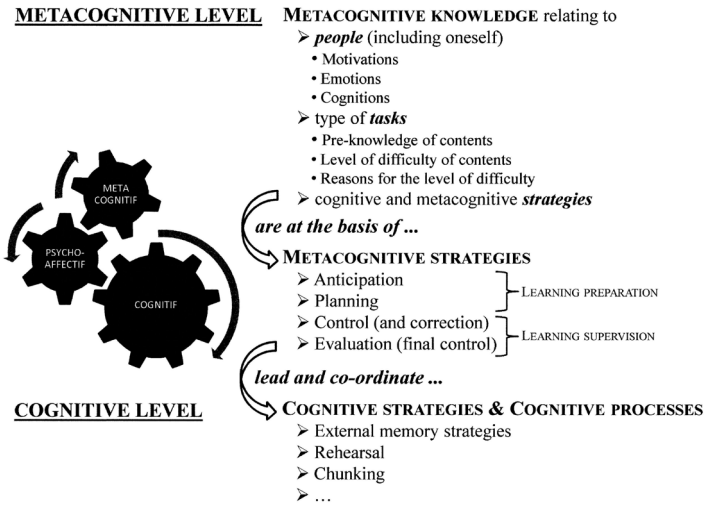

Fig. 1. *Metacognitive and Cognitive Theory of Learning to Learn*

lead the learner into "moving off their own centre" and give them the opportunity to think about their own functioning: that is, adopt a meta stance. It is through these metacognitive experiences that the learner will be able to (a) build, develop and activate his metacognitive abilities and also (b) develop his strategic *repertoire*.

What does the Theory explain and predict?

The theory described above may explain why numerous students are having school difficulties. These are mostly linked to the way they learn: they do not use efficient methods. Therefore, it would be necessary to teach them how to learn. Many "Learning to Learn" approaches have appeared over time. However, in general, they do not enable the student to (a) reflect on his/her own learning behavior, (b) build up greater self-awareness (including psycho-affective characteristics), (c) improve general strategies such as anticipation, planning, continuing control and evaluation, and (d) develop his/her strategic *repertoire* (*e.g.*, active memorizing, understanding instructions, external memory strategies). In fact, the majority of existing approaches do not work on a metacognitive level. If we really want the student to set up an efficient learning method

and be able to adapt to the teachers' requests (which evolve over time), it is essential, in our opinion, to work on a metacognitive level as well.

The theory described above may be used to predict future success of the EDUCA + project because its purpose is to design products which will, on the one hand, enable field workers to detect "sleeping" potential among students, and, on the other hand, to help them develop a more efficient learning behavior.

What is EDUCA +?

EDUCA + is at the crossroads between several disciplines and based on wide field experience. Its objective is to increase the expertise of "front line" field workers by developing specific products such as tools, training courses, services, and a website (Frenkel, in press). This will notably enable them to develop their expertise, detect "sleeping" potential, diagnose, give advice when necessary, intervene (prevention and remediation) and use the tools efficiently.

Two types of tools are being designed. On the one hand, assessment tools (tests allowing to put forward the learner's strengths and weaknesses as well as the scope of his/her "sleeping potential"). On the other hand, intervention tools (short prevention *vs.* remediation programs). This also includes training courses and services. The creation of a website also aims to reinforce the actions of EDUCA + (personalized access depending on the internaut's profile: students, parents, professionals).

Products

The products arise from various disciplines: Developmental Psychology, Cognitive Education, Cognitive Sciences, Clinical Psychology, Systemic applied to the school field, Neuro-Cognitive and Behavioral Approach.

- *Tools*. Test for dynamic assessment (complete version for psychologists, abridged version for teachers). Intervention tools: «reading comprehension (second year of secondary school, mainstream education)» (metacognitive remediation programme centered on reading comprehension strategies) and prevention programmes for primary school (centered on metacognitive abilities improvement);

- *Training courses*. Main themes: specific learning impairments, differential diagnosis, tools for leading school activities, understanding and improving metacognitive abilities... Target public: psychologists, speech therapists, people working in *CPMS* (see below), teachers, parents, pedopsychiatrists;
- *Website*. On-line test, personalized coaching, downloadable files, post training follow-up platform…

Partnerships

There are four main partners:

- The *CPMS*. The purpose of the Social, Psychological and Medical Centers (*CPMS*) is to improve the students' psychological, psychopedagogical, medical and social conditions in order to offer them the best chances of developing harmoniously all the aspects of their person so as to take on their role as responsible and autonomous citizens. The *CPMS* contribute to the education process of the students all along their school years, by favoring the implementation of means which will enable them to improve themselves continuously. With a view to lifelong guidance, these Centers provide support to students in the positive building of their life project: personal, educational, and professional. In Belgium, each school is linked to a *CPMS*.
- *Assess Group*[1]. This firm is specialized in competencies assessment, pedagogical engineering, training impact assessment, and in developing technological support for assessment (mainly throughout their web-based platform Docimo, Optical Markup Reading and Voting System). Its consultants are academics involved in international projects and work on the basis of proven scientific models both in the literature and on the field. It is active on the Belgian, French and Swiss market.
- *Interface Entreprises-ULg*[2]. This Interface between companies and the University is an internal service from the University of Liège (ULg) set up to organize and implement the economic part of the

[1] http://www.assess-group.be.
[2] http://www.interface.ulg.ac.be.

University's third mission: service to the community. Today, the *Interface Entreprises-ULg* is responsible for setting up collaborations between companies and the University, developing the results of research, managing intellectual property, involving the University in regional development, and organizing continuing education in the technological and scientific fields.

- *Pr. Fredi BÜCHEL* (University of Geneva). He participates in this project as the main scientific partner. He brings his expertise in the creation of learning tests and metacognitive intervention material. He is also involved in the scientific assessment of diagnosis and intervention tools. This is partly related to programs and materials he developed for the training of practitioners, the DELF/DELV metacognitive intervention program (Büchel & Büchel, 1995, 2011) and the QsA diagnosis tool (Büchel et al., 2011).

The complementarity of these partnerships will enable the EDUCA + project to reach its objectives. The *CPMS* reinforce the expertise of the EDUCA + team, enable privileged access to the field (collection of information and testing of products) and a better spreading of information. *Assess Group* and the *Interface Entreprises-ULg* bring entrepreneurial expertise and enable a high quality supervision in the possible setting up of a Spin-off. Besides, *Assess Group* brings this expertise as a consultant in the field of Human Resources and Education in order to develop a commercial approach within the EDUCA + project.

CONCLUSION

Led by the *School Psychology Unit*[1] of the University of Liège, the EDUCA + project is both part of the clinical activities of the Unit (*Atelier d'Apprentissage*[2]) and its research activities on intellectual functioning in learning situations, the prevention of school difficulties and the setting up and standardization of tools designed to assess and remedy learning difficulties.

[1] http://www.fapse.ulg.ac.be/web/pscol/.
[2] http://www.fapse.ulg.ac.be/cms/c_319405/psychologie-scolaire.

By building these innovative tools, our research will try to provide a better definition of the cognitive, metacognitive and psycho-affective aspects that play an essential role in the emergence of school difficulties linked to the learning method. Identifying, formalizing and implementing these aspects will, hopefully, make it possible to prevent learning difficulties and also to evaluate and attempt to remedy them. One of our aims is to facilitate the creation of new training courses contents and to increase the efficiency of the pedagogical methods concerned. The services proposed will thus be more relevant to meet the field needs and enable students to use their learning potential fully and develop it further. These are the objectives EDUCA +.

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METAKOGNITYVINIAI KOMPONENTAI MOKYMOSI MOKYTIS POŽIŪRIU

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Santrauka. ***Įvadas.*** Daugeliui besimokančiųjų iškyla sunkumų mokykloje. Tai susiję su tuo, kaip jie mokosi. Kartais tai įvardijama kaip „metakognityvinis deficitas“. Straipsnyje remiamasi „neatskleisto potencialo“ požiūriu. Psichologai, mokytojai ar tėvai – visi jie stengiasi plėtoti savo įgūdžius, kad galėtų padėti besimokantiesiems. Taip yra pradinėse ir vidurinėse mokyklose. EDUCA+ projektas skirtas galimiems sprendimams surasti. ***Tikslas.*** Šio straipsnio tikslas – pateikti metakognityvinę ir kognityvinę mokymosi mokytis teorijas, kurios (a) paaiškins, kodėl daug mokinių turi mokymosi sunkumų ir (b) leis numatyti EDUCA+ projekto sėkmę.

Pagrindiniai žodžiai: metakognicija, mokykla, mokinys, potencialas, dinaminis įvertinimas.

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