

# Relationships between Metacognition, Self-efficacy and Self-regulation in Learning

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## LE RELAZIONI TRA METACOGNIZIONE, AUTO-EFFICACIA E AUTO-REGOLAZIONE NELL'APPRENDIMENTO

### ABSTRACT

*The ability to manage study activities by themselves is one of the educational goals that learners should achieve at the end of secondary school. Self-regulation, however, includes a variety of metacognitive issues. Firstly, self-regulated students should be aware of the mental processes they rely on when performing cognitive tasks, of the degree of autonomy they are allowed in managing study activities and of how effective they are in facing school demands. Secondly, students should be able to plan and monitor study activities strategically. Thirdly, students should identify the kind of learning which is expected to be reached. A sample of 130 students were administered 5 different of questionnaires designed to investigate the metacognitive awareness (MAI: Schraw & Dennison, 1994), the perception of autonomy in school learning (AILI: Elishout-Mohr, Van Daalen-Kapteijns, & Meijer, 2004), the sense of self-efficacy (Adaptive Self-Efficacy Scale: Sibilis, Schwarzer, & Jerusalem, 1995), the attitudes of study strategies (LASSI: Weinstein & Palmer, 2002), and the questionnaire on the conceptions of learning (QAPCOL: Pérez-Tello, Antonietti, Liverta-Sempio, & Marchetti, 2002). Results revealed that self-regulated learning is linked to metacognitive skills such as planning, monitoring, evaluation and concentration. In addition, the knowledge and the proper use of learning strategies – such as the selection of the main ideas in a text – constitutes a related set of metacognitive skills. Finally, it was found that the acquisition of metacognitive knowledge, skills and attitudes is linked to autonomy in the study and to self-efficacy.*

*Keywords:* Metacognition, Motivation, Self-efficacy, Self-regulated learning, Study strategies.

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## 1. INTRODUCTION

### 1.1. *The role of metacognition in learning*

Metacognition, self-efficacy and self-regulation are three constructs which have been recently proposed as relevant to help students to organize their study activity independently and effectively. Such constructs include some common concepts, but their relations have not been systematically investigated, at least in instructional settings. The aim of this paper is to contribute to understand how metacognitive skills, self-efficacy and self-regulation are related to one another and how they contribute to make students aware of their weaknesses and potentials in study. Metacognitive ability concerns the awareness about and the control over the way information is acquired, processed and stored in the human mind, and how it differs from cognitive skills, which instead consist of managing the content to be learned.

Metacognition includes the knowledge that each person has about how his/her own cognitive processes work (Flavell, 1976 and 1979) and mental activities which control these processes (Cornoldi, 1995). In the metacognitive approach the distinction between the knowledge of cognitive functioning and the control mechanisms, which consists of the evaluation and monitoring of the learning process (Cavanaugh & Perlmutter, 1982), has been proposed. Therefore, metacognition concerns not only the knowledge of mental processes involved in knowledge acquisition, but also includes procedures of control and adjustment of the knowledge acquisition mechanisms themselves. Jacobs and Paris (1987) identified three different types of metacognitive knowledge: declarative, procedural and conditional. Declarative knowledge is the knowledge that every individual has regarding the characteristics of his/her own learning and includes knowledge about the person, the activities and the strategies. Procedural knowledge is the knowledge of procedures to use with regard to study strategies. Conditional knowledge refers, ultimately, to the knowledge of when and why certain strategies have to be used. As regards metacognitive control, different components can be identified as well, such as: self-instruction, which relates to the knowledge of how, when and why to use certain strategies (Brown, 1975); self-interrogation, based on the reflection on the validity of the strategies used; self-monitoring, which

consists of periodic control of the proper use of the strategies implemented to perform the task (Cornoldi, 1990). Several studies stressed the essential role of monitoring in the metacognitive processes, as it allows students to be aware of progress and gaps in their learning processes (Serra, 2009).

The concept of metacognition is closely related to the concept of «learning to learn» by Novak and Gowin (1989), according to which it is important for students to acquire and store new knowledge, but also to learn how to use, connect and transfer knowledge from one domain to another. The metacognitive skills in fact enable students to implement these processes in addition to organizing study in stages, as well as to monitor and evaluate learning activities (Cornoldi, 1995). Many studies have been carried out in recent years in the field of metacognition and most of them highlighted the relationships between metacognition and learning objectives (Sungur & Senler, 2009), between metacognition, academic achievement and the learning environment (Hacker, Bol, & Keener, 2008; Dunlosky & Metcalfe, 2009; Efklides, 2010; Zabrocky, Agler, & Moore, 2009; Dimmit & McCormick, 2012), and between metacognition and intelligence (Cornoldi, 2010) and problem solving (Antonietti, Ignazi, & Perego, 2000). It has been shown that metacognitive skills lead students to set the learning goals, to manage the learning environment by themselves and to apply strategies effectively so as to better organize their study. More precisely, metacognitive skills enable students to choose and make proper use of study strategies, which become conscious and controllable activities (Pressley *et al.*, 1983). In particular, the appropriate use of study strategies requires an effective capacity of metacognitive reflection and adequate motivation (De Beni & Moè, 2000). The study strategies are related especially to reading and writing since the role of metacognition is to support the understanding of texts (Chonan & Sawa, 2009; McKeown & Beck, 2009; Harris, Santangelom, & Graham, 2010). Indeed, metacognitive skills allow the student to conceptualize, control and regulate the process of reading and writing, helping him/her to memorize and understand notions and to develop critical thinking about what he/she has learned.

### *1.2. Metacognition and self-efficacy*

Several studies highlighted the close relationship between metacognition and some constructs connected to self-efficacy, such as anxiety for the academic performance (Legg & Locker, 2009), the proper use of study strategies (Aydin, Uzuntiryaki, & Demirdogen, 2011), the challenge concerning the completion of the task (Coutinho, 2008), as well as the interest (Tella, Tella, & Adeniyi,

2009) and the identification of learning objectives (Age, 2011). Self-efficacy was found to be a strong predictor of academic performance (Coutinho & Neuman, 2008). Bandura (1977 and 1990) was the first who studied and defined the concept of self-efficacy. According to him, self-efficacy is the belief that a person has in his/her ability to increase motivation, to mobilize cognitive resources and to perform the actions necessary to exercise control over the task.

Bandura (1981 and 1989) also specified the sources from which self-efficacy originates and develops: past experience, vicarious experience, imaginative ability, verbal persuasion, physiological and emotional conditions. Past experience, which includes successes and failures, helps to increase or weaken the efficacy beliefs. The vicarious experience can increase effectiveness, depending on the quantity and quality of learning experiences that the individual is able to observe and emulate. Imaginative capacity allows the individual to figure out and anticipate situations, events and emotional reactions that may impact on the sense of efficacy (Cervone, 1989; Williams, 1995). Verbal persuasion is based on the person's ability to exercise appeal on the basis of what he/she says. Physiological conditions influence the effectiveness as an aversive state towards a performance causes a failure and generates doubts about one's own capabilities. Finally, emotional conditions, as high levels of anxiety or depression, can adversely affect the efficacy beliefs.

The components of self-efficacy influence learning by modulating types of objectives, information processing and amount of feedback supplied (Nota & Soresi, 2000). Among these different components, the types of objectives and information processing are probably the most important, as they play a crucial role in the learning process. The power of goals in influencing self-efficacy beliefs depends on proximity to the goal, level of specificity and difficulty. The temporal proximity of the goals, for example, not only promotes self-efficacy, but also motivation and skills acquisition (Bandura & Schunk, 1981). Specific objectives make evaluation and monitoring of the target achievement easier. The difficulty of goals, finally, allows one to develop new skills and abilities. Regarding the relationship between type of goals and self-efficacy, Schunk (1995) distinguished between performance objectives, based on achievement, and mastery objectives, linked to the acquisition of the strategies and the techniques to achieve the desired outcome. The latter type of goals seems to influence self-efficacy more positively than performance goals, since the awareness to use the appropriate strategies helps one to increase self-efficacy and motivation.

The relationships between information processing and self-efficacy are based on the belief that students with difficulties in understanding and in knowledge processing face the study with insufficient self-efficacy beliefs. Bouffard-Bouchard, Parent and Larivée (1991) showed that self-efficacy

beliefs are predictors of academic success more than the skills acquired, as the students' poor performance may be due either to the absence of the necessary skills or to the inability to properly use these skills. The basis of good cognitive performance is, therefore, the personal effectiveness in the use of skills, but also the ability to self-regulate learning. To facilitate the development of self-efficacy beliefs, students must rely more on the mastery of the strategies that make them independent in their learning progress, rather than on the attendance of a certain level of performance (Schunk & Rice, 1991). A greater sense of self-efficacy allows the students to be autonomous in their study and have an interest in what they learn, in contrast to the ineffectiveness that makes them passive and inattentive to the learning process.

Metacognitive skills are not sufficient to ensure the quality of learning, as it is fundamental to know how the strategies related to the task are enforced and monitored, but also how to organize the learning environment, how to adjust motivational, affective and socio-cognitive skills in order to realize aspirations (Bandura, 2000). The beliefs that students have about their academic performance affect their cognitive, motivational and affective processes (Bandura, 1996). From the cognitive point of view, when self-efficacy beliefs are strong, students tend to choose challenging learning objectives and try to achieve them with great efforts (Locke & Latham, 1990). The sense of self-efficacy stimulates the student to persevere in achieving certain objectives, even in the presence of obstacles, and leads him/her to the strategic use of all abilities (Prat-Sala & Redford, 2010). The relationship between affective processes and self-efficacy is, indeed, bi-directional, because of the absence of self-efficacy beliefs determine depression and negative affective states, which in turn have a negative influence on self-efficacy (Boekaerts, 2007; Zhu, Zhang, & Wu, 2011). Some studies have analyzed the strong influence that the sense of self-efficacy has on students' beliefs about their ability to regulate their own learning and on teachers' beliefs about their self-efficacy in promoting learning (Houtveen, van de Grift, & Creemers, 2004; Den Brok, Brekelmans, & Wubbels, 2004; Thoonen, Slegers, Peetsma, & Oort, 2011). In conclusion, the relationships between self-efficacy and metacognitive skills allow students to foster a high level of confidence in their own abilities, encouraging them to have a positive approach to learning and to consider the difficulties as challenges rather than threats to be avoided.

### *1.3. Metacognition and self-regulated learning*

The concepts of metacognition and self-efficacy are closely related to those of «self-determination» and «self-regulation» (Pellerey, 2006). The term «self-

determination», when referred to learning, emphasizes the role of choice and intentional action, as well as of motivation and decision. The term is associated to monitoring, evaluation and control over the learning process. On the other hand, the concept of «self-determination» refers to the perception of competence that every person has not only about his/her behaviour, but also in relation to his/her thoughts and emotions. The term «self-regulation» refers instead to the subject's ability to participate actively in his own learning in terms of metacognition and motivational (Zimmerman, 1989). In other words, self-regulation is considered as a process through which students transform their mental abilities into academic skills, such as expert reading and competent writing (Zimmerman & Labuhn, 2012). According to the social-cognitive theory of human behaviour, self-regulation is the ability of the subject to influence the external environment through self-observation, self-judgment and self-reaction.

Studies conducted by Zimmerman (1986) defined the concept of self-regulated learning, meant as a process through which students activate cognitions and behaviours oriented to the achievement of their academic goals. In the field of self-regulation the relationships that this construct has with other important components of the learning process, such as metacognition (Fox & Riconscente, 2008), self-learning and self-regulated learning (Maggioni & Parkinson, 2008; Winters *et al.*, 2008), were investigated. Also the peculiarities and the overlaps of the concepts of self-regulation, self-regulated learning and metacognition (Dinsmore *et al.*, 2008; Kaplan, 2008; Efklides, 2008; Lajoie, 2008; Hofer & Sinatra, 2010) have been stressed. The ability to regulate study enables students to avoid the distractions that usually occur in the learning process, because it stimulates the development of the interest in the knowledge (Fries, Dietz, & Schmid, 2008). With the increase of self-efficacy and self-regulation skills the interest in school activities grows, as well as the satisfaction with the achieved results. Self-learning, hence, is a skill that students are able to gain if they can reach high levels of motivation and if they develop cognitive and metacognitive skills (Bandura, 2000). Cognitive abilities help to understand and process knowledge and to structure and analyze problems in order to find a solution. Metacognitive skills help to monitor the regulatory thinking in terms of how it is used in understanding and solving problems.

The process of the development of the self-regulation competence comprises three phases (Zimmerman, 2000): preparation, implementation and reflection. In the preparation phase, a plan of action is drawn up and the integration among the various dimensions of the self and the perception of the problem to be solved occurs (Pellerey, 1999). In this process, learning objectives are identified and, if the level of self-efficacy is high, the subject is

more likely to achieve his/her goals. In the implementation phase the action is accomplished through self-control and self-observation. Self-control includes self-education actions and it is based on the use of appropriate strategies to achieve the learning objectives. Self-observation is based on actions aimed at monitoring the activities and collecting information on the effects of learning. The reflection phase comprises two distinct processes: the evaluation of the results achieved and the detection of the subject's cognitive and motivational reactions to the results he/she has achieved. The three phases are cyclical and, in particular, the last one (reflection), influences the first (preparation). Self-regulation skills have, as recognized by the socio-cognitive theory, a social nature, as students need the help of the others to improve their skills: at first they ask for help to their parents and later to teachers, showing a high sense of school effectiveness (Zimmerman & Martinez-Ponz, 1990).

The social nature of self-regulation has been studied in some researches that have investigated the influence of the personality and the characteristics of sociality on the academic success (Caprara, Vecchione, Alessandri, Gerbino, & Barbaranelli, 2011) and the relationships between social context, self-efficacy and demotivation (Alivernini & Lucidi, 2011). This longitudinal research studied the influence that the social relations and socio-economic conditions have on the academic performance of students attending high school and how social relations can sometimes be the cause of the abandonment of studies. Self-regulation skills are necessary to acquire the ability to write, which is considered one of the most important skills, especially for high school students who, arriving in their last year and preparing for their final exam, become anxious and fear they may not be able to write properly.

Self-regulation is necessary for writing activity, which is generally planned and carried out by oneself and requires a creative effort sustained over time (Wason, 1980; Bereiter & Scardamalia, 1987). The writing activity involves the dimension of self-regulation (Prat-Sala & Redford, 2012) and includes motivation (Mason, Meadan, Hedin, & Cramer, 2012) and metacognition. Hayes (1996) emphasized the importance of motivation in the writing activity and, after having identified the phases of planning, transcription and revision, as phases of the development of the written paper (Hayes & Flower, 1980), also highlighted the relationships between the quality of the production and the affective-motivational aspects. Anxiety, for example, affects the writing process, resulting in a negative sense of efficacy that determines the failure of the writing activity. The metacognitive dimension consists of the use, by students, of writing strategies, processes and tools (Boscolo, 2002). According to the pedagogical point of view, writing helps the individual to understand, to express him/herself and to communicate meaningful experience which takes an educational value.

## 2. OBJECTIVES OF THE RESEARCH

The main goal of the study was to deepen the relationships among metacognition and the related dimensions mentioned in the introduction. Firstly, we were interested in assessing the association between the general metacognitive attitude and self-efficacy. Secondly, the study was aimed at investigating the relations between metacognitive attitude and some issues connected to self-regulation in learning, such as the goals the student sets (as revealed by his/her implicit conception of learning), the perceived autonomy and the control over the learning strategy. Thirdly, the relationships between self-efficacy and these issues were also addressed. In fact, we have reason to predict that the students' autonomy in managing their study should be associated to their sense of self-efficacy in dealing with school demands. Also the strategic capacity of the students to plan and monitor their study activities should be related to self-efficacy. Lastly, the students' ability to identify the type of learning goals to be achieved should be associated to self-efficacy as well.

The components of self-regulation we took into consideration should be associated with one another, too. Metacognitive abilities and the appropriate use of the study strategies should be associated with the students' self-efficacy beliefs. The associations between the ability of students to be autonomous in their study and self-efficacy depends on the influence that self-efficacy has on students' skills, such as planning, monitoring and identifying the goals of study activities.

Bandura (2000) argued, in fact, that the sense of self-efficacy is associated to the belief that the persons have about their ability to organize the sequence of correct actions to achieve certain results. Students who have a high sense of self-efficacy tend, for example, to identify key objectives and are willing to make use of all their hard work and perseverance to achieve them. In contrast, students with a low sense of self-efficacy are vulnerable to anxiety and are not able to conduct their own studies. On the other hand, as regards the relationships between the components of the self-regulation considered in our research, such as metacognition, self-efficacy and the ability to successfully use the strategies of study, metacognition – understood as the knowledge and control that students have of their own learning process – helps to increase the sense of self-efficacy, which in turn makes students aware of the correct choice of study strategies to be used according to the different contexts.

An ancillary aim of the research was to study the reliability of some tools that for the first time in Italy were administered in secondary schools, in order to identify the metacognitive, strategic skills and sense of self-efficacy of students. As another secondary goal, the research also addressed relations



between items within the questionnaires we used. In particular, we analysed the correlations between the subscales of the questionnaires and their internal structure.

### 3. METHODS

#### 3.1. *Participants*

One hundred and thirty students, ranging in age from 17 to 20 years and attending the last year of high school, participated in the study. We decided to engage students attending their last year of school because we believed that the variables we were focusing on are essential particularly for students who are preparing to take the state exam and facing work and future university studies. Five schools took part to the investigation: 3 vocational training school and 2 technical schools located in the city of Milan. The participating schools were contacted by telephone. We later met the school principals in order to explain the research project and to jointly agree on the days and times to implement the project.

#### 3.2. *Research instruments*

The students were given 5 questionnaires: *Metacognitive Awareness Inventory* (MAI), *Adaptive Self-Efficacy Scale*, *Questionnaire About the Popular Conceptions of Learning* (QAPCOL), *Awareness of Independent Learning Inventory* (AILI), *Learning and Study Strategies Inventory* (LASSI). Except for the second and third questionnaires, these tools were used for the first time in Italy and the study is offered as a first data collection for their Italian validation.

General metacognitive attitude was assessed by the *Metacognitive Awareness Inventory* (MAI; Schraw & Dennis, 1994). The instrument includes 35 items and the metacognitive skills of the students were analyzed by 4 subscales: monitoring, planning, evaluation, strategies. In particular, the questionnaire investigated the metacognitive skills of students in the ability to plan, evaluate and monitor their own learning and the ability to use appropriate learning strategies. Planning involves «the selection of appropriate strategies and the allocation of resources that affect one's learning performance» (Schraw & Moshman, 1995, p. 354). The skills referable to planning are setting goals, selecting appropriate strategies and scheduling time and

strategies. Monitoring, instead, involves «one's on awareness of comprehension and task performance» (Schraw & Moshman, 1995, p. 355). Finally, evaluating refers to «appraising the products and regulatory processes of one's learning» (Schraw & Moshman, 1995, p. 355). The response scale for each item ranges from 1 («almost never») to 5: («very often»). Cronbach's alpha values computed for each subscales ranged from .79 to .85 (Schraw & Denison, 1994).

The Italian version (Sibilia, Schwarzer, & Jerusalem, 1995) of the *Adaptive Self-Efficacy Scale* (Jerusalem & Schwarzer, 1979) was administered. The scale was created to assess a general sense of perceived self-efficacy with the aim in mind to predict coping with daily hassles as well as adaptation after experiencing all kinds of stressful life events. The instrument is composed of 10 items and the response scale for each item ranges from 1 («not at all true») to 4 («exactly true»). Good reliability coefficients (Cronbach's alpha ranging from .76 to .90) as well as acceptable item-total correlations (Luszczynska, Gutierrez-Dona, & Schwarzer, 2005) have been reported in the literature. Test-retest coefficients ranged from .65 to .75, showing an adequate stability over time (Schwarzer & Jerusalem, 1995).

The shortened version of the *Questionnaire About the Popular Conceptions of Learning* (QAPCOL; Pérez-Tello, Antonietti, Liverta-Sempio, & Marchetti, 2002) was employed to recognise the model of leaning the students had in mind, which is connected to the kind of goals each model implies. The version of the questionnaire which was employed in this study consists of two sections for a total of 35 items: the first section includes 18 items related to beliefs about the learning process and the second section consists of 17 items relating to the feelings and personal meanings related to the learning experience. In the QAPCOL specific factors emerged: conceiving learning as addressed at imitating an expert model, conceiving learning as a matter of affective involvement and discussion, conceiving learning as a personal thought activity, conceiving learning as aimed at reducing deficits, conceiving learning as concentration and commitment, conceiving learning as a negative experience, conceiving learning as having opportunities to test one's self-efficacy, conceiving learning as a matter of will and pleasure, duty and challenge (Pérez-Tello, Antonietti, Marchetti, & Liverta Sempio, 2005). The students were asked to express their level of agreement or disagreement on a Likert scale. The psychometric properties of the questionnaire are fully reported in Pérez-Tello, Antonietti, Liverta-Sempio and Marchetti (2002) and in Cantoia, Giordaneli, Pérez-Tello and Antonietti (2011).

The perception of autonomy in school learning was measured by means of the *Awareness of Independent Learning Inventory* (AILI; Elshout-Mohr, Van Daalen-Kapteijns, & Meijer, 2004). The authors of his tool use the

term «independent learning» to designate a type of learning that is direct by metacognition. The instrument consists of 45 statements, 15 for each of the dimension mentioned below. Students are asked to circle a number on a 7-point scale for each statement. The response scale ranges from 1 («not true at all») to 7 («completely true»). In AILL, three components have been distinguished within metacognition: metacognitive *knowledge*, metacognitive *skills*, metacognitive *attitude*. Metacognitive *knowledge* refers to personal category about strategies and study tasks; metacognitive *skills* concern orientation and evaluation on one's own functioning in a learning episode, monitoring one's execution of a learning episode; metacognitive *attitude* includes sensitivity to metacognitive experiences (internal feedback during learning), sensitivity to external feedback on one's cognitive functioning and curiosity with respect to one's own cognitive functioning and development. Data supporting the reliability and validity of the questionnaire were reported by Meijer, Elshout-Mohr, Van Daalen-Kapteijs and Meeus (2003).

Strategic study attitudes were assessed by asking participants to fill in a shortened version of the *Learning and Study Strategies Inventory* (LASSI; Weinstein & Palmer, 2002). LASSI measures learners' awareness about the use of learning strategies related to components of skill, will and self-regulatory learning strategy. This abbreviated version of the questionnaire consists of 43 statements (selected among the original ones, which often overlap one another) and of 10 subscales: attitude (students' interest in school and academic success), motivation (students' diligence, self-discipline and willingness to exert the effort necessary to successfully complete academic requirements), time (students' application of time principles to academic situations), anxiety (degree to which students worry about school and their academic performance), concentration (students' ability to direct and maintain attention on academic tasks), information processing (how well students can use imagery, verbal elaboration and reasoning skills as learning strategies to help build bridges between what they already know and what they trying to learn and remember), selection main ideas (students' skills at identifying important information for study from among less important information and supporting details), study aids (students' use of supports or resources to help them or retain information), self-testing (students' use of comprehension monitoring techniques to determine their level of understanding of the information to be learned), test strategies (students' use of test preparation and test taking strategies). The Cronbach's alpha values computed for each scale of the questionnaire ranged from .71 to .91 (Perels, Guertler, & Schmitz, 2005). Table 1 provides readers an overview of the dimensions investigated through the questionnaires described above. To summarise, the three constructs on which the study was focussed were assessed as follows:

Metacognitive skills were tested through MAI and QAPCOL; self-efficacy was evaluated through the *Adaptive Self-Efficacy Scale*; self-regulation of learning was analyzed by AILI and LASSI.

Table 1. – Research instruments and corresponding investigated dimensions.

INSTRUMENTS	DIMENSIONS
Metacognitive Awareness Inventory (MAI)	General Metacognitive attitude Metacognitive skills: <ul style="list-style-type: none"> <li>• Monitoring</li> <li>• Planning</li> <li>• Evaluation</li> <li>• Strategies</li> </ul>
Adaptive Self-Efficacy Scale	General sense of perceived self-efficacy
Questionnaire About the Popular Conceptions of Learning (QAPCOL)	Kinds of learning: <ul style="list-style-type: none"> <li>• Imitating expert model</li> <li>• Affectivity and discussion</li> <li>• Personal thought</li> <li>• Deficit reduction</li> <li>• Concentration and commitment</li> <li>• Negative experience</li> <li>• Opportunities for self-efficacy</li> <li>• Will and pleasure</li> <li>• Duty and challenge</li> </ul>
Awareness of Independent Learning Inventory (AILI)	Perception of autonomy in school learning: <ul style="list-style-type: none"> <li>• Metacognitive knowledge</li> <li>• Metacognitive skills</li> <li>• Metacognitive attitude</li> </ul>
Learning and Study Strategies Inventory (LASSI)	Use of learning strategies: <ul style="list-style-type: none"> <li>• Attitude</li> <li>• Motivation</li> <li>• Time</li> <li>• Anxiety</li> <li>• Concentration</li> <li>• Information processing</li> <li>• Selecting main ideas</li> <li>• Study aids</li> <li>• Self-testing</li> <li>• Test strategies</li> </ul>

### 3.3. Procedure

The students were administered the set of self-report instruments listed above in three separate sessions. The administration of questionnaires was always preceded by a presentation in order to explain the research objectives and to assure students on the anonymity of responses since the purpose of the research was not evaluative. The declared objectives of the study were to detect the metacognitive skills.

It is worth mentioning, even though this has no relation with the research phase, that after having collected the protocols, some training sessions were organized, always during school hours, in order to help students to fill in some of the gaps and concerns that they had about the way they deal with their final exams. The topics covered during the training sessions focused, in particular, on the use of learning strategies and the way to control the anxiety that usually affects students when they are going to take an exam. The administration of the questionnaires was, in fact, embedded in an educational project aimed at supporting students to prepare for their final exams and the questionnaires were used as starting stimuli to encourage students to reflect.

## 4. RESULTS

### 4.1. *Internal structure of the questionnaires*

To analyze the relations between the subscales of each instrument, we calculated Pearson's correlation coefficients.

As regards MAI (Table 2), positive statistically significant correlations emerged for all the four subscales, suggesting that all the metacognitive dimensions assessed by this instrument are related to one another in order to contribute to determine a general metacognitive attitude.

In QAPCOL a few subscales were reciprocally correlated in a significant manner (Table 3). There was a positive relation between the belief that learning is a relation with an expert model and affectivity and discussion, individual thinking, learning as reduction of deficits and personal experience which leads to perceive learning as a set of opportunities and self-efficacy. The last concept was connected with affectivity and discussion and with learning as will and pleasure. There were also two negative correlations between negative learning experiences and the concept of learning as opportunity and self-efficacy and with learning as will and pleasure.

Table 2. – Correlations between MAI subscales.

	PLANNING	EVALUATION	STRATEGIES
Monitoring	.745	.666	.713
Planning		.666	.759
Evaluation			.609

Table 3. – Significant correlations between QAPCOL subscales based on factorial analysis.

	AFFECTIVITY AND DISCUSSION	PERSONAL THOUGHT	REDUCTION OF DEFICITS	OPPORTUNITIES AND SELF-EFFICACY	WILL AND PLEASURE
Relationship with the model expert	.346	.480	.313	.342	
Affectivity and discussion				.311	
Negative experienced				-.434	-0.391
Opportunities and self-efficacy					.546

The subscales of AILI revealed several positive significant correlations (Table 4). Considering the complex structure of the questionnaire, we preferred to report the connections between the subscales in a schematic way. Inside the *metacognitive knowledge* we found significant links between:

- personal categories with guidance and monitoring (metacognitive skills) and with the internal and external feedback (metacognitive attitude);
- strategies with the tasks of study (metacognitive knowledge) and evaluation (metacognitive skills);
- the tasks of the study correlate with all the metacognitive skills (orientation, monitoring and evaluation) and the internal feedback (metacognitive attitude).

*Table 4. – Significant correlations between ALLI subscales.*

	METACOGNITIVE KNOWLEDGE	Orientation	Monitoring	Evaluation	Internal feedback	External feedback	METACOGNITIVE ATTITUDE
	About study strategies						
	In the person category	.300	.374		.381	.492	
Metacognitive knowledge	About strategies	.470	.332				
	About study tasks	.331	.381	.388	.301		
	Orientation		.502	.455		.334	.411
Metacognitive skills	Monitoring			.364	.384	.483	.390
	Evaluation					.366	.335
Metacognitive attitude	Internal feedback					.412	
	External feedback						.435

Turning to the subscales of *metacognitive skills*, we observed that the subscales guidance, monitoring and evaluation correlated with each other. In addition:

- the orientation and evaluation correlated with the external feedback and curiosity (metacognitive attitude);
- the monitoring, on the contrary, correlated with the whole of the attitude subscale metacognitive (feedback internal, external, curiosity).

Finally, in the subscales of the *metacognitive attitude* we found a connection between internal and external feedback and between the external feedback and curiosity.

LASSI presented a lower number of significant correlations among the subscales (Table 5). In particular, the level of anxiety, understood as the students' concern about school and performance, were correlated with the ability to select relevant information within a text and the ability to use strategies to prepare and take tests. In turn, the last subscale was negatively correlated with the interest that students show for school and for their success in school. The concentration has a positive relationship with the ability to select important information with time management and strategies to prepare for and take the tests. The ability to connect existing knowledge with new information was related to self-assessment about the student's level of preparation. Finally, the time management in the learning process is connected with the ability to select the important information and the use of strategies to prepare and support test. In turn, the latter two subscales were linked.

Table 5. – Significant correlations between LASSI subscales.

	SELF-ASSESSMENT	SELECTING MAIN IDEAS	TIME	STRATEGIES TEST
Anxiety		.324		.526
Attitude and interest				.318
Concentration and attention		.382	.450	.436
Information process	.409			
Selecting main ideas			.325	.628
Time				.343



4.2. *Relationships between the questionnaires*

We analyzed the relations between the instruments (Table 6). Significant relations between the *Adaptive Self-Efficacy Scale* and other instruments emerged. In particular, we found positive correlations between the basic metacognitive skills (monitoring, planning, evaluation and strategies) evaluated through the MAI and the perception of self-efficacy. This means that when the student possesses metacognitive skills, he/she also has a high sense of efficacy in the study, and vice versa. LASSI presented some negative connections. When concern for school performance is very high, there is a negative perception of self-efficacy. The inability to discriminate relevant information within a text and inability to use strategies to prepare and take a test were negatively correlated to self-efficacy. Motivation and connecting prior knowledge with the new were connected to the perception of effectiveness in the study.

Self-efficacy and autonomy in the study, measured through the AILI, showed positive correlations with metacognitive knowledge (in person category and study tasks) and the metacognitive attitude in study (in particular, external feedback and curiosity). There was only one negative correlation between self-efficacy and internal feedback. One could speculate that the presence of significant internal feedback affecting the ability to feel is effective in the learning process.

*Table 6. – Significant correlations between self-efficacy and the subscales of the other instruments.*

MAI	LASSI	AILI	QAPCOL
Monitoring .357**	Anxiety -.237**	In person category .238**	Relationship with model expert .202*
Planning .206*	Information processing .208*	Study tasks .305**	Affectivity and discussion .273**
Evaluation .307**	Motivation .185*	Internal feedback -.198*	Personal thought .306**
Strategies .255**	Main ideas -.193	External feedback .190*	Negative experienced -.187*
	Strategies test -.205*	Curiosity .207*	

\*  $p < .05$  \*\*  $p < .01$

Table 7. – Factorial analysis: rotated factor matrix.

FACTORS	1	2	3
MAI – Planning	.795		
MAI – Evaluation	.769		
MAI – Monitoring	.760		
MAI – Strategies	.694		
LASSI – Information process	.653		
LASSI – Self-assessment	.537		
QAPCOL – Negative experienced	-.492		
QAPCOL – Opportunities and self-efficacy	.474		
AILI - Monitoring	.465		
LASSI - Evaluation	.353		
QAPCOL – Concentration and commitment	.303		
LASSI – Strategies test		.830	
LASSI – Selecting main ideas		.736	
AILI – Internal feedback		.635	
LASSI – Concentration and attention		.622	
LASSI – Support material		.608	
LASSI - Anxiety		.607	
QAPCOL – Affectivity and discussion		-.435	
QAPCOL - Personal thought		-.427	
QAPCOL – Duty and challenge		-.396	
QAPCOL – Will and pleasure		-.381	
AILI – About strategies		.302	
AILI – In the person category			.641
AILI – About study tasks			.588
AILI - Orientation			.529
AILI – External feedback			.526
LASSI - Time			.471
LASSI – Attitude and interest			-.452
QAPCOL – Relationship with model expert			.422
QAPCOL – Reduction of the deficiencies			.402
AILI - Evaluation			.287
AILI - Curiosity			.252
Self-efficacy	.233	-.448	.316

Finally, with regard to the relations between *Adaptive Self-Efficacy Scale* and the QAPCOL, having negative experiences related to learning was associated to the perception of ineffectiveness, while conceiving learning as a relations with a more experienced model and as individual thinking were associated to an increased sense of self-efficacy. Factor analysis led to identifying some latent variables (factors), which explain the links between the questionnaires (Table 7). After a Varimax rotation, the 3 extracted (according to the Scree test) factors can be labeled as follows: self-regulated learning, appropriate use of learning strategies, autonomy in study. Self-regulated learning referred to the basic metacognitive skills such as planning, evaluation, monitoring and use of strategies. The first factor includes also student's skills such as concentration, commitment, motivation to study, the absence of negative experiences and experiencing learning as an opportunity for personal growth and enrichment. The second factor referred to student's ability to properly use study strategies, such as selecting the main ideas in a text, relying on supporting materials as notes, diagrams and conceptual maps. In this way the student is able to enhance critical thinking about the subject under study and to live learning in a pleasant way as a challenge, being able to manage anxiety in a conscious way. Finally, the acquisition of knowledge, skills and metacognitive attitudes were related to autonomy in study and to self-efficacy.

## 5. CONCLUSIONS

Our study had primary and secondary objectives. From a methodological point of view, the secondary aims precede the primary ones, since assessing the relations between the three constructs on which the study was focused (metacognition, self-efficacy and self-regulation) required testing whether the employed instruments were reliable. As secondary goals, the analysis of the internal structure of each instrument showed that the subscales are correlated with one another in coherent ways, so supporting the notion that the Italian versions of the questionnaires, which had never been used previously in our country, are valid.

Moving to the primary aims of the study, metacognitive skills were assessed through the administration of the MAI. This instrument allowed us to detect the students' ability to plan, assess and monitor their own learning skills that help to strengthen the metacognitive attitude. Metacognitive attitude resulted to be associated also to the sense of self-efficacy, measured through the *Adaptive Self-Efficacy Scale*, which showed that students with higher metacognitive skills have a high sense of self-efficacy.

The relationships between the metacognitive attitude and sense of self-efficacy also emerged from the results of the QAPCOL, which showed that negative experiences related to learning are associated with the perception of ineffectiveness, whereas critical and individual thinking, as well as metacognitive skills, help to develop a greater sense of self-efficacy.

The relationships between the metacognitive attitude and the sense of self-efficacy also emerged from the analysis of the AILL, which appeared to link together knowledge with metacognitive skills. The aim of identifying the associations between metacognitive attitude and self-regulation in learning was achieved through the administration of the LASSI: data showed that the inability of students to use appropriate strategies, as well as the lack of interest in school, highlight a lack of ability to self-regulate. In general, findings showed that the student's ability to monitor one's own learning process lead him/her to increase his/her sensitivity to the feedback that the educational context offers him/her, but, above all, helps to develop the curiosity and interest of the student about the object of study. Interpretation of the data also showed that the quality of the student's own study will help to make him/her more active and responsible, as well as to promote the development of some higher skills such as the selection of the correct strategies to take an exam and the identification of relevant information within a text. Commitment and concentration help the student to manage time more efficiently, with a selection of the effective strategies tailored to the objective of the study. The ability to self-assess the level of preparation helps the student to connect the previously acquired knowledge to the new by integrating it into a uniform and consistent set thus increasing the sense of self-efficacy.

The data collected from the questionnaires also showed that learning is regarded by students as an opportunity to reduce their deficits and as an opportunity that helps them to develop individual thinking and their sense of self-efficacy, as it makes the individual surer of him/herself and of his/her ability. The findings supported the notion that the vision of learning as a result of the relation with a more experienced model helps the student to grasp not only the opportunity to deepen and expand his/her knowledge, but also to develop critical thinking on the subject matter of study and to increase his/her sense of self-efficacy. Correlations between the different subscales of the questionnaires also highlighted the negative function played by anxiety in the learning process. Anxiety appears to be the cause that prevents students from achieving good results in examinations and that causes them to make poor decisions on the study strategies to use. In contrast, concentration seems to help students successfully manage their study time and the identification of the main concepts in their textbooks. The subjects covered by our research have implications for theoretical and applied use in the field

of education. The concept of self-efficacy has favored, for example, the shift from hetero-education to self-education, that is, the transition from an education run only by the outside to an education chosen and planned by the person who is directly involved in the educational process.

The concept of self-education was already present in the educational literature with Freinet (see, in this respect, Prévot, 1963), who stressed the importance of the self-organization of students and identified the basic principles of the process of collective self-education. In the last century, the importance of the concept of self-education was also highlighted by the currents of thought of the «new pedagogies» and the «new schools», which called for forms of self-government, and by Dewey (1986) as well. In addition, studies in psychology on the concept of self-efficacy have pedagogical implications in life and in school career. The sense of collective self-efficacy of teaching contributes, for example, to promoting a climate of collaboration, the reconciliation of conflicting interests, the development of a shared sense of commitment, in order to improve, through evaluation, the quality of the education system as a whole (Domenici, 2007). In particular, from an educational point of view, the methodology that promotes the development of metacognitive skills, a sense of self-efficacy and self-regulation in students, is that of the didactic laboratories, because it presents itself as a physical and social context which acts as a conditioner and mediator of the activities (De Bartolomeis, 1978). With regard to the characteristics of the educational and teaching laboratories, which promote the development of study skills and self-regulation in students, Frabboni (2001) identified some of them as the relation style, interdisciplinary, non-individualized strategies, the educational project, all aimed to activate the processes of invention and critical interpretation of the acquired knowledge.

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## RIASSUNTO

*La capacità di gestire le attività di studio è uno degli obiettivi formativi che gli studenti dovrebbero raggiungere al termine della scuola secondaria. L'auto-regolazione, tuttavia, comprende una varietà di aspetti metacognitivi. In primo luogo, gli studenti in grado di auto-regolarsi dovrebbero essere consapevoli dei processi mentali che sono alla base dell'ese-*

*cuzione dei compiti cognitivi; in secondo luogo, dovrebbero essere in grado di pianificare e monitorare le attività di studio; in terzo luogo, dovrebbero essere capaci di identificare il tipo di apprendimento da raggiungere. L'obiettivo della ricerca è stato quello di studiare questi aspetti e le loro relazioni reciproche. A un campione di 130 studenti frequentanti l'ultimo anno della scuola superiore sono stati somministrati 5 questionari finalizzati a indagare la consapevolezza metacognitiva (MAI: Schraw & Dennison, 1994), la percezione di autonomia nell'apprendimento scolastico (AILI: Elshout-Mohr, Van Daalen-Kapteijns, & Meijer, 2004), il senso di auto-efficacia (Adaptive Self-Efficacy Scale: Sibilis, Schwarzer, & Jerusalem, 1995), le strategie di studio (LASSI: Weinstein & Palmer, 2002) e le concezioni di apprendimento (QAPCOL: Pérez-Tello, Antonietti, Liverta-Sempio, & Marchetti, 2002). Dall'analisi dei dati è emerso che l'auto-regolazione nell'apprendimento è collegata a competenze metacognitive quali la pianificazione, il monitoraggio, la valutazione e la concentrazione. Oltre a ciò, la conoscenza e l'uso corretto delle strategie di studio – come la selezione delle idee principali in un testo – costituiscono un ulteriore gruppo di competenze metacognitive. Infine, è emerso che l'acquisizione di conoscenze, abilità e attitudini metacognitive è legata all'autonomia nello studio e al senso di auto-efficacia.*

*Parole chiave:* Auto-efficacia, Auto-regolazione nello studio, Metacognizione, Motivazione, Strategie di studio.