The Role of Metacognition in Teaching

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The desideratum of postmodern education is the forming of human beings who are capable of judging. In this regard, learning means doubting, criticizing. Metacognitive training facilitates the approach whereby students are taught how to learn, how to process the information, how to think independently and effectively. But, metacognitive knowledge, which is knowledge about one's own way of thinking, of understanding, and of learning, must be doubled by a metacognitive behavior, which aims at the strategies and the abilities used to plan, to organize, and to adjust one's own learning activities. This case study aimed, on the one hand, to assess teachers' awareness about the role of metacognitive strategies in teaching and, on the other hand, to understand how teachers use metacognitive strategies in their work with students in order to achieve performance. The research was conducted in secondary schools from Bihor county, Romania. In the case of teachers, a self-report instrument was used, called Teachers' Metacognitive Awareness Inventory (TMAI). The instrument used with students was a 15-item questionnaire. The results of the research show that there is a gap between the theory of metacognitive strategies and how they are applied in didactic activities.

Introduction

The term "*metacognition*" was used for the first time by *J. H. Flavell* in 1976. According to Flavel, metacognition refers to "knowing about one's own knowing" and the control procedures used to develop one's own cognitive activity. Activities such as planning, approaching a learning task, monitoring, understanding and evaluating the progress made in achieving the task, are all of metacognitive nature.

Metacognition refers to a higher-level thinking, "*thinking about thinking*", which assumes an active control on the cognitive processes involved in the learning process. According to Flavell, 1979, the metacognitive thoughts are deliberate, planned, intended, and the behaviors are mentally directed towards the future so that they are used to achieve the cognitive tasks. Summarizing, metacognition refers to the person's knowledge of their own cognitive processes and products, such as the active control of regulating and organizing

these processes in order to fill the cognitive gaps (Flavell, *cf.* M. Grangeat).

Subsequent to the studies of Flavell, metacognition has become a field of interest for many researchers in the field of psychology and for many educationalists, who have interpreted it in different ways:

- self-appraisal and self-management of the cognitive system, aspects included by *Paris and Winograd*, 1990, in what they called self-efficacy theory;
- the person's knowledge of how their thinking works and using this knowledge to control their own mental processes (Saint-Pierre, 1994); a continuous mechanism of readjustments or of balancing in the process of self-knowledge (idem);
- reflecting on, intuiting the way of dealing with a task, a problem, a situation, including the identification of negative aspects, so that they can be avoided later by using connections built consciously and in a controlled way, in various contexts, through self-regulation (Joiţa, 2002).
- metacognition is nothing else but focusing on the self, on how it manifests itself in the learning process… it is the discussion on the meaning and importance of our deeds, which allow the structuring of intelligence and the building of a personal self (Cerghit, 2002);
- it is a look on one's own cognitive activity, either when it actually happens, as a support, as a research for the effective strategy, or after it, in order to understand what made the activity successful and become aware of strategies that can be used in various other contexts (Cerghit, 2002);
- *Büchel* (2000) correlates metacognition with learning style, which highlights meta-knowledge and specific executive functions;
- metacognition is a positive factor of transfer and self-instruction; "*insinuating itself as a reflection of the person who learns on their own learning process, it opens new perspectives on action and on remedy during the teaching process*" (Cucoş, 2006);
- "*procedurally, three main significances of metacognition can be noticed, which become educational goals: a) knowledge; b) control, regulation and management of goals, activities, tasks; c) re-examination of school conduct by deepening the awareness about the quality of educational directions, as well as the control and regulation operations through positive or negative feedback*" (Neacşu, 2010).

J. H. Flavell's studies, and then those of *A. L. Brown*, on the process of metacognition have drawn attention on two of its components: metacognitive knowledge and metacognitive skills.

Metacognitive knowledge refers to the declarative aspect of metacognition and it includes the subject's knowledge and beliefs on cognitive phenomena. In comparison with other types of knowledge stored in the long-term memory, metacognitive knowledge consists of information that is actively used in the regulation of cognitive processes. Its major role is to manage a person's cognitive resources in order to successfully solve a target task. It integrates the knowledge that refers to the cognitive activity, such as the way attention, memory, understanding, decision making, learning strategies work etc., and to its products. Metacognitive knowledge has a relatively stable nature, being declarative and reflective (Brown, 1987), and can be acquired and adjusted by learning and experience.

It is worth mentioning that a student can use different metacognitive knowledge to solve the same task. For instance, in the case of a test in Romanian language and literature: ″I know that I (knowledge about oneself) solve more easily grammar exercises than literature assignments (knowledge about the task), so I will do the syntax exercises first and then I will go on to the assignments (strategic knowledge)″. Metacognitive knowledge can generate a conscious experience, which Flavell (1987) calls *″metacognitive experience″*. This is a cognitive or emotional experience which is part of the intellectual activity and which determines the metacognitive adjustment to the task (re-evaluation of a plan, dropping or changing a strategy).

Metacognitive skills refer to individuals' understanding and control of their own cognition.

Seven metacognitive skills (Sternberg, 2005) are very important: identifying the problem, defining the problem, presenting the problem, defining the strategy, allocating the resources, monitoring problem solving, evaluating problem solving. All these skills are processes by which the control, or self-regulation, of an activity is performed when solving a problem. *Cognitive regulation* includes the set of activities that allow information processing at various levels of depth (deep processing, superficial processing and strategic processing). Thus, cognitive skills become manifest by the cognitive strategies the subject turns to. *Metacognitive regulation* is the resultant of corroborating knowledge (declarative, procedural and conditional) with metacognitive strategies (of information management, of unblocking, of evaluation and of planning). Metacognitive regulation contributes to a better performance by a more effective use of the attentional resources and of the available strategies.

Most studies emphasize three regulating strategies: *planning, monitoring* and *evaluating.*

Planning refers to setting the intermediate and final goals of a task, to anticipating its stages, to selecting working strategies based on goals and to allocating the time and resources needed to solve the task. Studies show that planning skills develop with age (predominantly between the ages of 10 to 14) and in time they become less and less dependent on the particular context of a task (Schraw, 1998).

Monitoring (Control) refers to the effort of monitoring and adjusting of an action while looking at the goal and the model of the action. Monitoring implies awareness about the level of comprehension and of performance (for example, *If we know this thing, what can we learn?", "Is this way of working effective?").* The results of monitoring are used to make decisions on planning the time and the concentration effort based on task difficulty, as well as to adjusting performance considering the goal. In case of imbalance between performances and the results expected, the subject starts a correction process.

Evaluating refers to appraising the products and the effectiveness of learning. It focuses mainly on the degree to which the final result overlaps with the one expected (that is, the degree of attaining the goal set forth). In case the results of monitoring do not overlap with those anticipated, evaluation requires changes in the correction process. These changes can mean restarting the process, rewriting the goals, revising the conclusions, redistributing the resources, making corrections.

Learning is often a toilsome process, which also includes difficulties and failures. Nevertheless, when facing the same learning challenges, some students overcome them quickly and flawlessly, while others are unable to perfom successfully. Everything depends on each individual's learning capacity. However, this faculty is not something that is just passed on as some knowledge is passed on. It is built in time and developed gradually through some complex mental operations. That is to say, "learning is learnt". This learning of learning assumes awareness of what is learnt, of one's own characteristics and cognitive powers, which allows development of individualized learning practices. Building this way of learning should become an integral part of the teaching activity, which means that teachers must go beyond the stage of the mere pedagogical encouragement of "learn" addressed to students.

The following questions arise: What instruments are available for students to monitor and regulate their strategic learning behavior? And which of them would make them responsible for what they do, for the results of learning? Focusing on the metacognitive mechanisms and supporting students to become aware of them, and to use them, will contribute to a better learning potential and to a stronger personal responsibility for the learning process. And the next

question that could arise is: At what age do metacognitive mechanisms start to work? Studies dedicated to personal development have shown that the possibility of developing self-regulation can start at a young age and goes on until adulthood. *Schwebel* (1983) have shown that children start to assume the social role of mediation at a very young age, and then they go on slowly: in other words, they become their own mediators. They regulate their own thinking and by performing self-criticism, they place themselves between the stimuli of the environment and their own reactions. In time they will learn to control and analyze their mental mechanisms, a practice called metacognitive process.

Method and results

General Background of Research

The aim of this study was to research the teachers' awareness of metacognitive strategies and how they use them in the teaching process so that they create a metacognitive environment for students. The objectives of the study were: (1) the teachers' evaluation of their own metacognitive approaches by filling in the TMAI questionnaire; (2) researching the way students exploit metacognitive strategies; (3) analyzing the correlation between the teachers' theoretic perception of metacognitive strategies and what actually happens in schools ("espoused theory"/"theory in use"). Thus, the hypothesis of the study was that although teachers are convinced that they manage to create a metacognitive environment in the classroom, this does not actually happen.

Instrument and Procedures

The sample of the study consisted of 100 secondary school teachers with more than five years of teaching experience from schools in Bihor county, Romania, and 71 secondary school students from the same schools (grades 6 and 7). In both cases the simple random sampling procedure was used for choosing the people.

The first instrument used was the *Teachers' Metacognitive Awareness Inventory (TMAI)*, with its 24 items, which were interpreted based on the six aspects of metacognition: I. Declarative knowledge, II. Procedural knowledge, III. Conditional knowledge, IV. Planning, V. Monitoring, VI. Evaluating.

The second instrument was also a questionnaire, which focused on the same six aspects, with items adapted and validated for students

(grades 6 and 7). The students were from classes in which the teachers included in the evaluation with TMAI taught. The questionnaire was filled in at the beginning of the school year (Initial test) and then at the end of the school year (Final test). It is important to mention that the study did not include an intervention program, The only purpose was to understand the teachers' involvement in developing metacognitive strategies in students using educational activities, taking into account their self-evaluations with TMAI.

Besides these questionnaires, a key role in the study was played by the knowledge gained while observing lessons held by students of the University of Oradea within their teaching placement, as well as while supervising teachers from secondary educational institutions in the process of obtaining teacher certification level 1.

Results of Research

The results obtained after processing the answers received from teachers to the questions of the TMAI are presented in Table 1 and Table 2.

Table 1.

| Indicators	Frequency of teacher's answers (%)		
	Yes	Yes/No	No
I. Declarative knowledge			
1. I am aware of the strengths and weaknesses in my teaching;	97	3	-
7. I know what skills are most important in order to be a good teacher;	62	38	-
13. I have control over how well I teach;	63	25	12
19. I know what I am expected to teach	56	44	-
II. Procedural knowledge			
2. I try to use teaching techniques that worked in the past;	47	51	2
8. I have a specific reason for choosing each teaching techniques I use in class;	61	27	12
14. I am aware of the teaching techniques I use while I am teaching;	59	41	-
20. I use helpful teaching techniques automatically	60	40	-
III. Conditional knowledge			
3. I use my strengths to compensate for my weaknesses in my teaching;	67	31	2
9. I can motivate myself to teach when I really need to teach;	83	12	5
15. I use different teaching techniques depending on the situation;	80	16	4
21. I know when each teaching technique I use will be most effective	71	29	-

Averaging the answers, it can be seen that as far as the "espoused theory" is concerned, the declarative level, teachers claim that they exploit metacognitive knowledge in their teaching activity: always – 67.82%, sometimes – 30.20% and only 2.98% state that they do not take it into account. Among these types of metacognitive knowledge the smallest percentage is taken by the procedural knowledge – 57.5%.

Table 2.

Indicators	Frequency of teacher's answers (%)		
	Yes	Yes/No	No
IV. Planing			
4. I pace myself while I am teaching in order to have enough time.	68	32	-
10. I set my specific teaching goals before I start teaching.	96	4	-
16. I ask myself questions about the teaching materials I am going to use.	90	10	-
22. I organize my time to best accomplish my teaching goals.	89	11	-
V. Monitoring			
5. I ask myself periodically if I meet my teaching goals while I am teaching.	71	29	
11. I find myself assessing how useful my teaching techniques are while I am teaching.	24	74	2
17. I check regularly to what extent my students comprehend the topic while I am teaching.	90	8	2
23. I ask myself questions about how well I'm doing while I am teaching.	51	47	2
VI. Evaluating			
6. I ask myself how well I have accomplished my teaching goals once I have finished.	88	12	-
12. I ask myself if I could have used different techniques after each teaching experience.	78	18	4
18. After teaching a point I ask myself if I'd teach it more effectively next time.	93	7	-
24. I ask myself if I have considered all possible techniques after teaching a point.	46	48	6

All teachers claim that they give a particular attention to planning a teaching activity, they always set forth their goals, they look for the most appropriate means, they organize their time so that they are as effective as possible. Differences can be noticed in the case of monitoring, and even more when looking at evaluation. The aspects targeted by items 11, 23 and 24 have the lowest percentage, though they refer to a very important aspect, the one that looks at the "reflective teacher".

The charts below show even better the differences in answers based on the items suggested:

Planning

Monitoring
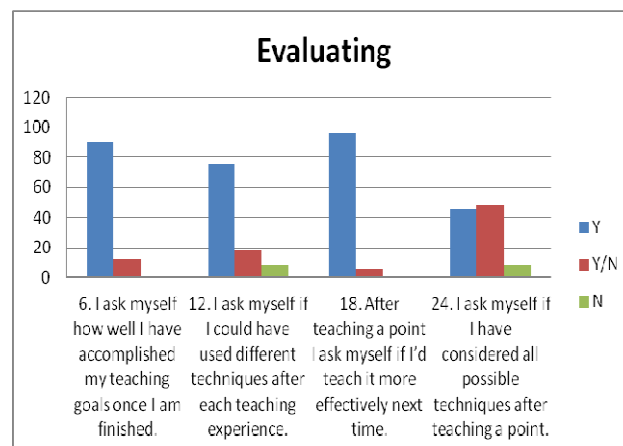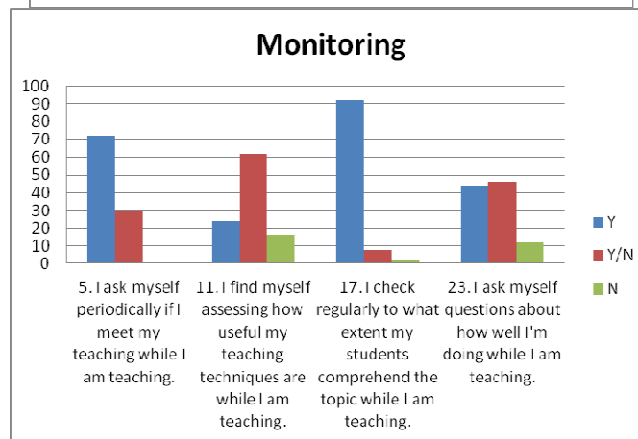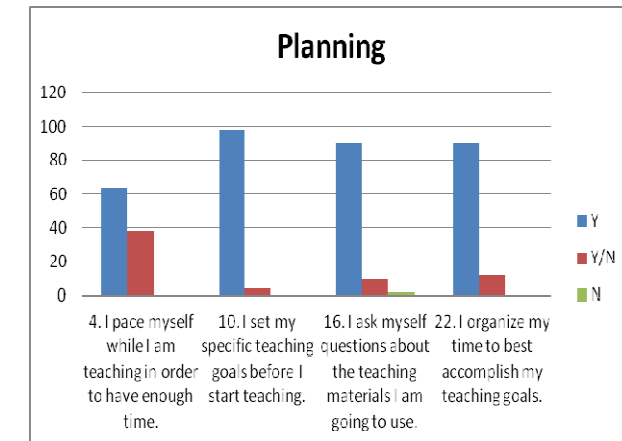
Evaluating

It can be noticed that there is a difference between the average of the positive answers regarding the planning of an activity and its evaluation, analysis based on the goals achieved. Some teachers do not give a close attention to this aspect, not even at the declarative level. Once the teaching activity is finished, they neglect or delay reflecting upon it. The chart below shows this situation:
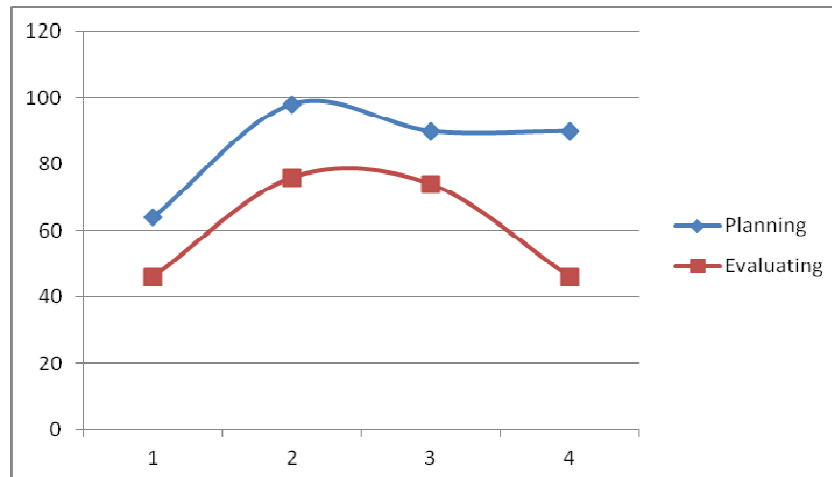
As it has been mentioned earlier, metacognitive mechanisms can start to develop at a very young age, children gradually learn to control, to analyze their own mental mechanisms and to organize their own learning activity.

The questionnaire administered to students revealed how students who are no longer at the beginning of secondary school (6th and 7th grades) feel equipped with metacognitive techniques and strategies. The items of the questionnaire focused on their command of metacognitive knowledge and strategies: *Do you set a certain amount of time to prepare for a lesson? Will you make a plan (strategy) before you do your homework? How interested are you in learning? Do you have the patience to read the entire information? Will you rely on a single source of information? Do you learn the theory before you do your homework? If you do not understand something, do you ask yourself why? Do you stop and ask yourself if what you learn makes sense? Are you thinking aloud while solving a task? If you do not understand something, do you ask a classmate?As you study, do you ask yourself whether you understand? Are you satisfied with what you are doing? Do you ask yourself if you could do better? Was teamwork productive?*

The results obtained after administering the test at the beginning of the school year (called Initial test) and then, the same questionnaire, at the end of the school year (called Final test) can be seen in the chart below:
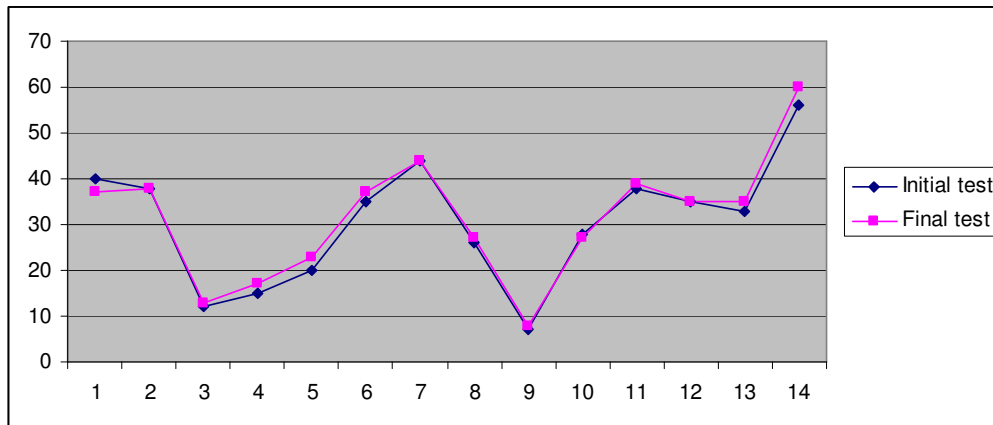
The difference between them is insignificant. As it has been mentioned earlier, the study did not include an intervention program, its aim was only to see if the teachers were interested in and capable of developing metacognitive mechanisms in students during their teaching activity, regardless of the school subject. It is not enough to claim that you possess these skills, or that you are a reflective teacher, but it is of utmost importance how you support students in their own learning activity.

Discussion

Teachers understand and interpret teaching in different ways, and these individual perspectives shape their theories or views on teaching, influencing inevitably the quality of the teaching process. Argyris and Schön (1974) use the term "theories of action". These theories of action include "the basic values, strategies and assumptions that inform about individuals' patterns of interpersonal behavior" (Schön, 1987, apud Argyris & Schön (1974). According to Argyris & Schön (1974), the theories of action result from the relationship between what the teacher *declares* when they describe and explain their teaching, on the one had, and, on the other hand, what they actually *do* while they teach. To be more precise, this is the relationship between "*espoused theory*" and "*theory in use*". The less the discrepancy between the two theories (espoused and in use), the more effective teaching becomes.

This study shows that, unfortunately, in the case of teachers included in the research the discrepancy is large. In their case, the espoused theory claims that the metacognitive knowledge and strategies are exploited in the teaching process, as well as that they are concerned with creating a metacognitive environment for the students. In reality, the picture is completely different.

Metacognitive knowledge and skills are developed as a result of the learner's activity, but also of adults' intervention, who should convert students into agents of their own thinking so that they become capable of organizing their own learning activity (learning how to learn). From this point of view, teachers should impose and encourage metacognition, be more concerned with creating a metacognitive learning environment (extended later beyond school) so that awareness of thinking and its management are encouraged.

Only against this background will teachers be able to shape in students a metacognitive behavior and, implicitly, deliberately develop metacognitive strategies. For example, help them become aware of their own approach to learning, of their own knowledge and skills, of the requirements of tasks, become aware of and choose their own learning strategies, monitor their own comprehension, manage learning time effectively etc. In brief, they should be placed in the situation of acquiring metacognitive procedures or strategies.

Besides the study itself, our supervision of the teaching activity in the schools included in the research has confirmed the teachers' minimal involvement in shaping a metacognitive behavior in students. More than 70% of the teachers blamed the still very busy curriculum in Romania. They said that they were under pressure for a faster pace of teaching than would be recommended. However, if the desideratum is an effective learning, that must include self-reflexion and self-control, which are things students should be taught, should have the chance to practice and they also should be advised on how to use them to perform better. In this way they will become more motivated to engage in metacognitive activities and they will understand that such activities can turn them into successful students, with better results. But the metacognitive environment must be created by the teacher.

Conclusions and Recommendation

In order to talk about genuine learning, students should learn how to learn, that is, develop metacognitive skills. In this process an important role is played by teachers, who should help students become aware of the fact that they should become responsible for their own learning and should use in the right way all their cognitive, emotional and motivational resources.

Thus, in order to develop metacognitive processes in students, teachers should take into account the following suggestions:
- initiate discussions about the metacognitive activities involved in solving learning tasks so that students can assess the difficulty of the task, set goals, choose appropriate strategies;
- encourage students to record their learning activities;
- provide continuous feedback;
- teach students to self-evaluate themselves in an objective way;
- initiate students in the self-questioning technique;
- plan the stages of the learning process;
- practice effective learning techniques;
- always follow the logic of things.

In order to make metacognition an active component of learning, teachers should embrace a reflective attitude on their own activity with students, choose the most appropriate teaching strategies, create an environment that is suitable for genuine learning and place the student in the center of the teaching process. Using mainly interactive-participative and metacognitive teaching strategies will place the student in the center of the teaching-training process, will stimulate them to get involved in both theoretical and practical training activities, will exploit their initiative, independence and creative potential, will arouse their capabilities to inquire and regulate their own cognitive, emotional and motivational processes. In order to develop students' metacognition and motivation, for both theoretical and practical activities, those strategies are recommended that focus on individual work, on solving tasks independently, along with strategies that stimulate self-reflection, interaction with others, conscious and responsible undertaking of teaching tasks, trust in one's own powers, development of spirit of initiative, independence of thinking, effective involvement.

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