The Use of Metacognitive Knowledge and Regulation Strategies of Students with and without Special Learning Difficulties

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Abstract

In the current research, the use of students' metacognitive strategies with and without special learning difficulties was studied as well as any differentiation of this use because of class or gender. The tool which was used was Junior Metacognitive Awareness Inventory, Version B (Jr. MAI) of Sperling et al. (2002) and is based on Brown's theoretical framework and includes the two dimensions of metacognition: "the knowledge of cognition" and "the regulation of cognition". It's the first time that the tool has been used in Greek student population of this age with and without special learning difficulties. Two hundred and forty students (245) participated in this research, 58 students with special learning difficulties and 187 students without special learning difficulties. The students of the two groups of the 5th and 6th grade presented several similarities regarding their preference in the use of the knowledge of cognition. The

differentiation which appears in the rates is mainly quantitative and refers to the frequency of the use of strategies and not qualitative, which indicates that both teams are faced with difficulties because of the regulation of cognition as a cognitive process of superior level. Girls in relation to boys in the total of the sample use more often the strategies of regulation of cognition and not of the knowledge of cognition.

Keywords: *metacognition knowledge, strategies, SLD, MAI Jr*

Introduction

Kuhn and Dean (2004) define metacognition as the awareness and the management of the thoughts of the individual and Swanson (1990) defines as one's ability to understand and monitor one's own learning and how to use a particular learning strategy in problem solving. In broad definition, it concerns "one's knowledge and control of their cognitive system" (Brown, 1987, 66). The term metacognition has been used as the knowledge and regulation of one's cognitive activities in learning processes (Brown, 1978; Flavell, 1979; Schraw & Dennison, 1994; Schraw, 1998). According to Flavell, (1979) and Efkleides (2008; 2011) metacognition refers to the awareness of the necessity of the use of certain strategies such as planning, information management, monitoring, evaluation (Schraw & Dennison, 1994; Pintrich, 1999; Papaleontiou-Louca, 2014). The distinction of metacognition into the metacognitive knowledge, experience, skill and the self-regulation and the methodological differentiation which it entails seems to be confirmed in several studies in different fields of knowledge (Efklides & Misailidi, 2010; Koulianou & Samartzi, 2012).

In contrast to the tools of measurement of metacognition used to adult students, there are very few self-reference questionnaires for the measurement of metacognition in reading to younger students. The review of Koulianou & Samartzi (2012), revealed: a) absence of tools of the metacognitive knowledge to children aged 7-11, b) absence of studies of metacognition and teachers' self-regulation c) very few studies on metacognition in relation to learning difficulties. Gascoine, Higgins and Wall's, (2016) presents the results of a systematic review of methods and tools that have been used to measure metacognition in children aged 4-16 years, at over a 20-year period (1992–2012). The final number of methods and tools for metacognitive assessment included in the analysis was only 80. The key findings of this review include self-report measures (including questionnaires, surveys and tests) comprise 61% of the included tools, observational methods that do not rely on prompting to 'think aloud' (think aloud protocols) have only been used with students aged 9 years and under.

Although the examination of metacognition continues even today to be a promising object that attracts the attention of the scientific community, we find that there is a limited range of tools for evaluation of metacognitive awareness both generally, or specifically in reading and even for younger ages. Aim of this study is the use of a tool that can measure both elements of knowledge of cognition and those of regulation of cognition (Schraw & Dennison, 1994) for students with and without learning difficulties. Secondly, it is the only self-report tool that can be achieved by measuring metacognitive deficiencies and intervention to develop metacognitive strategies (Sperling, Howard, Miller & Murphy, 2002).

The Theory of deficient skills and the metacognitive approach

In the past Learning Difficulties had been defined as deficits in basic cognitive processes,

indispensable for student involvement in academic works (Lerner, 2003; Wong, 1985). According to the theoretical framework of cognitive deficits very soon students with learning difficulties were considered to be lacking metacognitive thought (Wong, 1985). The turn to the study of metacognition and the disproof of the assumptions of the Theory of Deficient Skills by Health professionals as well as through the survey data, which did not confirm the deficient performance skills, marked out metacognition into a significant factor in the attempt to understand learning difficulties.

Turning to metacognitive consideration emphasis is placed on the performing child and Brown introduces the notions of "Knowledge of Cognition" and "Regulation of Cognition". Metacognition is defined by the terms of intentional and conscious control of the cognitive actions by the individuals themselves (Brown, 1978; Baker & Brown, 1984; Rouet & Eme, 2002).

Aydin & Ubuz (2010) in their study support the theoretical distinction of the two terms, metacognitive knowledge (Flavell, 1979) and metacognitive regulation (Brown, 1978). Metacognitive knowledge refers to acquired knowledge in terms of person, task and strategy (Flavell, 1979) while Brown (1978) classifies it into subcomponents as declarative, conditional and procedural knowledge. Flavell (1979) proposes a unified theory of metacognitive regulation referred to as conscious use of strategies of planning, monitoring, and controlling. On the contrary, Brown, (1978) presupposes the existence of planning, selecting, monitoring, evaluating and debugging processes without the necessity of awareness. Whereas both researchers regarded regulatory processes as strategic decisions, these decisions which individuals engage during the execution task are conscious for Flavell but unconscious for Brown.

The contribution of the study of the Metacognition will be judged crucial to the three areas of the Special Learning difficulties: 1. Metacognitive skills constitute the "pedestal" of the efficient study and reading (Brown, 1987). 2. Metacognition contributes to the understanding of the weak effort of the pupils with S.L.D. to conserve and generalize already taught knowledge, skills and strategies (Wong, 1986). 3. The crucial and central role of the phonological (metalinguistic) awareness as knowledge of the phonemes and the handling (control-regulation) as metacognitive skill is pointed out (Wong, 1986).

The new emerging metacognition models went on to the co-examination of the motivation factors and of metacognition (Bandura, 1993; Borkowski, Milstead & Hale, 1988). These models offer explanations as to how students' motives finally shape their strategic activities. Additionally, the coordination of the students' motives, knowledge and skills allows the recognition of the factors which threaten their successful participation in the cognitive work, as well as the utilization of the strategies of the metacognitive monitoring (Butler, 1998). Students with learning difficulties don't appear strong motives; they usually adopt passive forms of learning and are characterized by an attitude of "learned helplessness". These characteristics, which compose a vulnerability of motives for the children with Learning Difficulties, interfere and affect negatively the efficiency of cognitive and metacognitive actions of the students, making it difficult to generalize any results achieved.

Metacognition, metacognitive strategies and reading Comprehension

Up to nowadays Reading continues to be considered as the capstone of the academic work. In the field of reading, the theoretical framework of metacognition and the constructivist notion introduced by it, changes the perception about the way reading comprehension occurs and highlights the valuable role of the metacognitive strategies (Koutsouraki, 2009). In 1984, Baker

& Brown had already pointed out that metacognition is considered constructed course towards certain theories on reading. Reading comprehension becomes now a top-down process which emerges from knowledge organized into shapes. These shapes which contain organized prior knowledge affect the construction of meaning, the comprehension. Therefore, individuals structure their own interpretation about what they read, based on the existing shapes that are their personal prior knowledge (Smith, 2015; Koutsouraki, 2009).

The study of both the experienced and the beginners in various cognitive areas provides rich research data as the new research field of Cognitive Psychology. Very fast the proportion of experienced and beginners and their difference in the frequency of use of strategies was transferred to the field of learning difficulties and especially the reading ones in the form of experts-readers without learning difficulties versus poor readers with special learning difficulties. The research which was carried out according to this reasoning highlighted poor but existing strategies used by the beginners or poor readers. In fact, the use of some strategies was assessed as particularly poor to the experienced, the readers without special learning difficulties (Botsas & Padeliadu, 2003; Padeliadou, Botsas & Sideridis, 2002).

The experts' - novice's context and the use of strategies

The study of experts and novice's in various cognitive areas offers, as a new research field of Cognitive Psychology, rich investigation data. Very soon the proportion of experts – novice's and their difference in the frequency of the use of strategies was transferred to the field of learning disabilities and notably the reading ones in the form of experts – readers without learning disabilities versus poor readers with special learning difficulties. The research which was carried out under this concept revealed poor but also existent strategies used by the beginner or poor readers (Furnes & Norman, 2015; Padeliadou et al, 2002). Indeed, the use of certain strategies was assessed as particularly poor for the experts/readers without learning difficulties (Farahian, 2016; Bergey, Deacon & Parrila, 2015; Botsas & Padeliadu, 2003; Wong, 1994).

The profile of the children with reading difficulties

Furnes & Norman (2015) compared three forms of metacognition in normally developing readers and readers with dyslexia. Pupils with dyslexia showed insight regarding their reading difficulties but less general knowledge of how to approach a reading text. Very often they reported an absence of available reading strategies; however, both teams didn't differ in the use of deep and surface strategies. The writers conclude that the problems of dyslexia are not always connected with the lowest levels of metacognitive knowledge, metacognitive strategies or experiences.

Padeliadu et al (2002), explored the metacognitive skills in reading with the use of a verbal method and specifically with the questionnaire of Miholic to pupils of the last four grades of Elementary School and found that weak reading strategies are also used by children without difficulties in reading, which is probably due to the modern language teaching. The children with difficulties in reading possess metacognitive strategies, which are fewer and weaker than the strategies children of the same age use without having any difficulties in reading. They behave like younger children at the initial stages of reading. They possess few planning strategies of the reading process and they cannot select the proper strategies in order to deploy properly their cognitive skills. They know better strategies of weak and novice reading than strategies of good reading. They are likely to lack sufficient energy to bestow upon reading comprehension and develop metacognition due to time consuming and laborious cognitive effort to decode reading. Even when they possess certain strategies, they do not know when to use them and why in order

to achieve the desired target (the conditional knowledge). However, according to Griffith & Ruan (2005) and Brown, Armbruster & Baker (1986), the knowledge of cognitive processes is developed slowly. They have difficulty examining and evaluating the target of the reading trial or its results. Consequently, when the reach the end of their cognitive effort, they don't know if the results fulfill the necessary requirements, they can't redirect their efforts towards comprehension, when this is not achieved, with negative consequences to the final result. The weaknesses of children with reading difficulties as far as strategies are concerned prevent the evaluation of their cognitive efforts and sketch a passive reader, who is unable to modify its approach.

Metacognitive strategies and students with special learning difficulties

O'Malley and Chamot (1990) defined metacognitive strategies as "higher order executive skills that may entail planning for, monitoring, or evaluating the success of learning activity" (p.44), as any set of actions, plans, tactics, thoughts or behaviors that the learners employ to facilitate the comprehension, storage, retrieval, and use of information.

A common finding in several studies is that poor readers have less comprehension about which reading strategies are more suitable in different reading circumstances (Anderson & Ambruster, 1984). However, findings from the University students' area have shown that students having a history of reading difficulties use strategies to the same or greater extent (Corkett, Parrila & Hein, 2006). Finally, Gersten, Fuchs, Williams, & Baker (2001) in a study – review of several intervention studies, found that reading comprehension can be improved in students with learning difficulties through strategy instruction.

Furthermore, according to Wong (1994), during the teaching of strategies it is important for students with learning difficulties to be taught how to demonstrate awareness during strategy learning and transfer. Absence or inadequate awareness explains the weak transfer to students with SLD. According to Larkin (1989), students with learning difficulties must be taught simultaneously both the transfer of general strategies of knowledge which can be applied to various relevant areas, and the transfer of more specialized strategies applied to only specific knowledge areas.

Table 1. Differentiation between mean values and the existence of specific learning difficulties

	SLD	WLD	T-test
Jr MAI	3,44±0,58	3,78±0,48	*t* (243) =4,45*
Knowledge of Cognition	3,59±0,60	3,92±0,51	*t* (243) =-4,09*
Procedural knowledge	3,02±0,82	3,31±0,87	*t* (243) =-2,26*
Declarative knowledge	3,88±0,78	4,23±0,60	*t* (79,06) =-3,15*
Conditional knowledge	3,67±0,79	4,00±0,63	*t* (81,65) =-2,89*
Regulation of Cognition	3,29±0,69	3,63±0,60	t (243) =-3,67*
Planning	3,56±1,07	4,07±0,85	*t* (80,37) =-3,30*
Control	3,07±1,01	3,28±0,97	*t* (243) =-1,36*
Monitoring	3,37±0,84	3,65±0,80	*t* (243) =-2,26*
Management Information Ability	3,09±0,76	3,52±0,76	*t* (243) =-3,74*

p<0,05 Note: SLD: Children with special learning difficulties, WLD: Children without special learning difficulties

Metacognitive strategies can be taught to pupils with special learning difficulties (Furnes & Norman, 2015).

Method

The main aim of the present research was the investigation of the learning strategies and the metacognitive profile of the students both with and without learning difficulties. The research questions developed for this purpose, were oriented to: a) What qualitative or quantitative differences are observed between the use of metacognitive strategies of learning of students with or without learning difficulties? b) How is the metacognitive profile of the students with or without learning difficulties shaped through the above use and what differences are presented on the levels of knowledge of the perception and its regulation? c) What is the relation of the factor of sex and class in relation to the metacognitive information of the students with or without learning difficulties?

Participants

Two hundred and fort five pupils studying in Greek Primary Schools in Viotia took part in the research, average age 11,35 ± 0,61 years with or without special learning difficulties, formed two study groups; those with already diagnosed special learning difficulties (SLD) and those without special learning difficulties (WLD). In their total 117, (47,8%) were boys and 128 (52,2%) were girls. One hundred and four (42,4%) were five grade pupils and 141 (57,6%) were six graders with Greek as their first language.

The first group included 58 (23,7%) pupils, 27 (46,6%) boys and 31 (53,4%) girls of average age 11,48 ± 0,62 years, with already diagnosed special learning difficulties in Centers of Diagnosis, Evaluation and Support (CE.D.E.S.) and their cognitive difficulties were not due to other factors such as mental retardation, sensory impairments, emotional disturbances as well as socio-cultural differences. The difficulties had the students were confirmed by their teachers too. As research data imply, teachers' judgments about their students' performance are typically valid and correlate with the results of standardized performance tests (Martínez, Stecher, & Hilda, Borko, 2009). The second, included 187 pupils (76,3%), formally studying, 90 (48,1%) boys and 97 (51,9%) girls of average age 11,31 ± 0,61 years.

Instrument

In order to achieve the goal of the research we used the Greek adaptation of the scale for the metacognitive awareness, Junior Metacognitive Awareness Inventory, Version B (Jr. MAI) of Sperling et al. (2002) recently translated and evaluated for its psychometric qualities on the Greek population. Its construction is based on Brown's theoretical framework (1978), and includes the two dimensions of metacognition; the knowledge of cognition and the regulation of cognition, while it constitutes an evolution of the Metacognitive Awareness Inventory (MAI) of Schraw and Dennison (1994). The dimension for the knowledge of cognition measures the significative, the procedural and the occasional knowledge of the individual and is made up of nine questions. The dimension for the regulation of cognition measures elements such as the ability to manage information, planning, monitoring and control and is made up of nine questions (Sperling et al., 2002). In its total the scale of self-reference consists of 18 elements of self-reference in a five- point graded scale of measurement of Likert type. It was considered

important for its selection the fact that as a questionnaire it can be used easily whereas regarding research it has been proved that it can measure both the elements of the knowledge of cognition and those of the regulation of cognition (Schraw & Dennison, 1994). Additionally, it constitutes a unique tool of self-reference through which the measurement of metacognitive elements of pupils can be achieved and can be used as a tool for the diagnosis of the metacognitive weaknesses and of intervention for the development of metacognitive strategies (Sperling et al., 2002). Regarding the validity and reliability of the tool for this study, there was a successive evaluation of the indicator of internal cohesion Cronbach's α and the validity of notional construction through investigative factorial analysis. The indicator of internal cohesion Cronbach's α for the factors ranged from 0,72 to 0,77 while in its total the scale presented a rate/value equal to 0,80. Finally, satisfactory rates/values for both metacognitive dimensions came up through investigative factorial analysis.

Analyses

In order to explore the questions, teachers participating in an educational program about the development of metacognition in Primary Education were asked to give their pupils Jr. MAI, in the form of electronic questionnaires, after the teachers themselves had been trained to it. After the collection of the questionnaires and their connection to the demographic data of the subjects had been completed, the data were transferred to linear array tables in the statistical package Statistical Package for Social Science (S.P.S.S., Version 20.0) and were quantitatively analyzed. As for the missing values, though few in the total number of the questionnaires, we used the method of their replacement by the average. This particular method was considered more adequate than the alternative methods Listwise, in which each case which has a missing value for any variable is not included in the analysis, and therefore in this way the sample size can be reduced enough and Pairwise, in which each variable which has a missing value is not included in the analysis. Therefore, the method of replacement by the average includes all variables in the analysis in order to perform further tests. For the control of the differences among the subgroups of the sample we used the t-test and for the examination of the correlations, the correlation coefficient of Spearman's rho. As the level of statistical significance (p) 5% was set while findings with p-value <0.05 were considered statistically significant. For the presentation of descriptive characteristics averages (M) and standard deviations (SD) of the replies were used.

Results

Based on independent samples t-test, comparisons between the fifth and sixth grade pupils were evaluated on their performance in Jr MAI and in its subscales, as well as between genders, but also on whether or not they have special learning difficulties. According to the results of the analysis, pupils with special learning difficulties (M = 3,44, SD = 0,58) mark averages significantly lower t(243) =4,45, *p*= ,00 compared to those who do not belong to this group (M = 3,78, SD = 0,48) in Jr MAI. Similar differences also emerge in the scale factors regarding knowledge and regulation of cognition. Specifically students without learning difficulties mark a higher average score on the subscale for the knowledge of cognition (M=3,92, SD=0,51, t(243)=-4,09, *p*=,00) and on the subscale for the regulation of cognition (M=3,63, SD=0,48, t(243)=-3,67, *p*=,00), statistically significant. (See Table1.)

Association between SLD and MAI J. strategies

According to the results of the analysis, students with special learning difficulties (M=3,44, SD=0,58) marked averages significantly lower t(243)=4,45, *p*=,00 in relation to those not

belonging to this group (M=3,78, SD= 0,48) in Jr MAI. Similar differences also emerge in the scale factors regarding knowledge and regulation of cognition. Specifically students without learning difficulties mark a higher average score on the subscale for the knowledge of cognition (M = 3,92, SD = 0,51, t(243) =-4,09, *p*=,00) and on the subscale for the regulation of cognition (M=3,63, SD =0,48, t(243)=-3,67, *p*=,00), statistically significant in comparison to the students with learning difficulties (see: Table 1).

The average measurement value in procedural (M=3,31, SD=0,87, t (243)=-2,26, *p*=,024), declarative (M=4,23, SD=0,60, t(79,06)=-3,15, *p*=,002) and occasional knowledge (M=4,00, SD=0,63, t (81,65)=-2,89, *p*=,005) of students without learning difficulties was significantly higher compared to students with special learning difficulties. The same statistical differences were observed for the planning (M=4,07, SD=0,85, t(80,37)=-3,30, *p*=,001), monitoring (M=3,65, SD=0,80, t(243)=-2,26, *p*=.025) and information management capacity (M=3,52, SD=0,76, t(243)=-3,74, *p*=.00), for students without learning difficulties, as regards the regulation of cognition, although as far as control is concerned (*p*=,174>,05) the difference between the two groups is not statistically significant.

Finally, the superiority of the knowledge of cognition compared to the regulation of cognition is manifested for both groups of students, regarding their metacognitive profile. Specifically, the participants with learning difficulties mark higher average rates in the factor of knowledge of cognition (M=3,59, SD=0,60, CI: 95%, 2,00 to 4,67) in relation to the regulation of cognition (M=3,29, SD=0,69, CI: 95%, 1,78 to 4,67). The same is also observed in the group of students without learning difficulties who marked higher average rates in the factor of knowledge of cognition (M=3,92, SD = 0,51, CI: 95%, 2,78 to 4,89) compared to the regulation of cognition (M=3,63, SD=0,60, CI: 95%, 2,00 to 4,89).

To complement the above, it is observed that students with special learning difficulties diverge regarding the averages in either the scale or the factors, compared to those who don't have any learning difficulties, regardless of their gender. So the boys without learning difficulties marked an average 3,69±0,50, visibly and statistically higher t(115)=2,61, *p*=,010, compared to boys with learning difficulties (M=3,41, SD=0,46) in Jr MAI.

Furthermore, girls without special learning difficulties (M=3,85, SD=0,45) had statistically higher average rates than girls who had (M=3,47, SD=0,65, t(39,43)=-3.08, *p*=,004). Correspondingly similar variations between the average rates and the existence of special learning difficulties are presented to both boys and girls, regarding the knowledge factors and the regulation of cognition (see: Table 2).

Table 2. Intergender differences between the average values and the existence of special learning difficulties

s	Gender	SLD	WLD	T-test
Jr MAI	Boys	3,41±0.46	3,69±0,50	*t* (115) =2.61*
	Girls	3,47±0.65	3,85±0,45	*t* (39,43) =3.08* .
Knowledge of cognition	Boys	3,57±0.69	3,88±0,53	*t* (115) =-.031*
	Girls	3,57±0.69	3,96±0,49	*t* (40,14) =-2.89*
Regulation of cognition	Boys	3,20±0,62	3,61±0,49	*t* (115) =-2.18*
	Girls	3,36±0,74	3,75±0,55	*t* (41,03) =-3.13*

* p<0,05, Note: SLD: Children with special learning difficulties, WLD: Children without special learning difficulties.

Association between Gender and MAI J. strategies

According to the results of the transgender comparison, statistically significant differences between boys and girls with learning difficulties are not presented o n both the wide scale (*p*=,69), and in the knowledge factors of cognition (*p*=,78) and the regulation of cognition (*p*=,368), despite a slight preponderance of girls.
In contrast, differences occur between boys and girls without learning difficulties. So girls are marking average rates, significantly higher than boys in Jr MAI (t(185)=-2,36, *p*=,02) and on the subscale for the regulation of cognition. (t(185)=-2,86, *p*=,005). In the subscale for the knowledge of cognition, this difference is not significant (*p*=,29), despite a slight preponderance of girls in procedural (*p*=,57), declarative (*p*=,58) and occasional knowledge (*p*=,05). As far as the regulation of cognition is concerned, the differences are due to the statistically higher rates of girls in the control (t(185)=-3,78, *p*=,00) and monitoring (t(185)=-2,16, *p*=,03), versus boys, although non-statistical differences with slight predominance of the girls in the planning (*p*=,30) and information management capacity (*p*=,43) are also presented (see: Table 3).

Table 3. Intergender differentiations between the average rates and the existence of special learning difficulties

		Boys	Girls	T-test
Jr MAI	SLD	3,41±0,46	3,47±0,65	t (56) =-0,40
	WLD	3,69±0,50	3,85±0,45	t (185) =-2,36*
Knowledge of cognition	SLD	3,57±0.69	3,57±0.69	t (56) =0,28
	WLD	3,88±0,53	3,96±0,49	t (185) =-1,06
Procedural knowledge	SLD	2,98±0,75	3,05±0,88	t (185) =-0,31
	WLD	3,27±0,94	3,35±0,81	t (185) =-0,57
Declarative knowledge	SLD	3,99±0,71	3,78±0,81	t (56) =-0,99
	WLD	4,26±0,61	4,21±0,59	t (185) =-0,56
Conditional knowledge	SLD	3,66±0,76	3,68±0,82	t (56) =-0,10
	WLD	3,90±0,62	4,08±0,64	t (185) =-1,94
Regulation of knowledge	SLD	3,20±0,62	3,36±0,74	t (56) =-0,91
	WLD	3,61±0,49	3,75±0,55	t (185) =-2,86*
Planning	SLD	3,54±1,03	3,58±1,12	t (56) =-0,15
	WLD	4,00±0,92	4,01±0,76	t (185) =-1,04
Control	SLD	2,74±0,95	3,35±0,98	t (56) =-2,40*
	WLD	3,00±1,01	3,52±0,86	t (185) =-3,78*
Monitoring	SLD	3,46±0,84	3,30±0,84	t (56) =-0,70
	WLD	3,52±0,85	3,77±0,74	t (185) =-2,16*
Management information management	SLD	2,93±0,69	3,24±0,80	t (56) =-1,59

Association between grade and MAI J. strategies

The fifth grade students (of average age = 10,75 ± 0,32 years) with special learning difficulties and without showing any statistically significant differences in the average rates of

self-reference for both the total of the scale (*p*=,48), and the knowledge factors (p = ,398) and the regulation of cognition (*p*=,67) (see: Table 4)

Table 4 . Differentiations between the average rates of students with and without special learning difficulties and the grade they studied in

	Grade	SLD	WLD	T-test
Jr MAI	5th	3,53±0,55	3,61±0,49	*t* (102) =-0,71
	6th	3,39±0,58	3,91±0,43	*t* (51,13) =-4,95*
Knowledge of cognition	5th	3,66±0,54	3,77±0,52	*t* (102) =-0,85
	6th	3,55±0,63	4,04±0,48	*t* (51,23) =-4,27*
Procedural knowledge	5th	3,00±0,87	3,11±0,83	*t* (102) =-0,53
	6th	3,03±0,80	3,47±0,88	*t* (139) =-2,70*
Declarative knowledge	5th	3,92±0,74	4,16±0,64	*t* (102) =-1,44
	6th	3,86±0,81	4,29±0,56	*t* (49,01) =-3,03*
Conditional knowledge	5th	3,80±0,82	3,81±0,68	*t* (102) =-0,09
	6th	3,59±0,77	4,14±0,57	*t* (50,66) =-3,96*
Regulation of knowledge	5th	3,39±0,69	3,45±0,60	*t* (102) =-0,43
	6th	3,22±0,69	3,77±0,57	*t* (139) =-4,69*
Planning	5th	3,67±1,30	3,89±0,87	*t* (102) =-0,73
	6th	3,50±0,93	4,21±0,80	*t* (139) =-4,45*
Control	5th	3,10±1,08	3,19±0,99	*t* (102) =-0,40
	6th	3,05±0,98	3,33±0,96	*t* (139 =-1,51
Monitoring	5th	3,62±0,71	3,41±0,80	*t* (102) =-1,07
	6th	3,23±0,88	3,84±0,76	*t* (139) =-3,98*
Information management capacity	5th	3,07±0,69	3,36±0,79	*t* (102) =-1,50
	6th	3,11±0,81	3,66±0,71	*t* (139) =-3,88*
	WLD	3,48±0,79	3,57±0,75	t (185) =-0,80

* p<0,05 Note: SLD: Children with special learning difficulties, WLD: Children without special learning difficulties

In contrast, regarding the students of the sixth grade (of average age = 11,80±0,32 years), statistically significant differences emerged to the students with special learning difficulties and to those without, with the latter to excel both on the whole scale (M=3,91, SD=0,43, t(51,13)=-4,95, *p*=,00), and in the knowledge factors (M=4,04, SD=0,48, t(51,23)=-4,27, *p*=,00) and the regulation of cognition (M=3,77, SD = 0,57, t(139)=-4,69, p =,00) (see: table 4).

According to the results, as they are presented summarized in Table 5, it becomes evident that students with special learning difficulties do not increase the average rates of their answers from the fifth to the sixth grade (*p*=,39 in Jr MAI), as opposed to the students without learning difficulties who present a developmental course in their metacognitive awareness (t (185)=-4,33, *p*=,00).

Table 5. Developmental differentiations between the average rates of students with and without learning difficulties and the grade of study

		5th grade	6th grade	T-test
Jr MAI	SLD	3,53±0,55	3,39±0,57	*t* (56) =-0,88
	WLD	3,61±0,49	3,91±0,43	*t* (185) =-4,33*
Knowledge of cognition	SLD	3,66±0,54	3,56±0,63	t (56) =-0,64
	WLD	3,77±0,52	4,04±0,48	*t* (185) =-3,75*
Procedural knowledge	SLD	3,00±0,87	3,03±0,80	*t* (56) =-0,12
	WLD	3,11±0,83	3,47±0,88	*t* (185) =-2,88*
Declarative knowledge	SLD	3,92±0,74	3,86±0,81	*t* (56) =-0,30
	WLD	4,15±0,64	4,29±0,56	*t* (185) =-1,58
Conditional knowledge	SLD	3,80±0,82	3,59±0,77	*t* (56) =-0,95
	WLD	3,81±0,68	4,14±0,57	*t* (185) =-3,61*
Regulation of knowledge	SLD	3,39±0,69	3,23±0,69	*t* (56) =-0,88
	WLD	3,46±0,60	3,77±0,57	*t* (185) =-3,62*
Planning	SLD	3,67±1,30	3,50±0,93	*t* (31,810) =-0,52
	WLD	3,89±0,87	4,21±0,80	*t* (185) =-2,66*
Control	SLD	3,10±1,08	3,05±0,98	*t* (56) =-0,15
	WLD	3,19±0,99	3,33±0,96	*t* (185) =-0,97
Monitoring	SLD	3,62±0,71	3,23±0,88	*t* (56) =-1,71
	WLD	3,41±0,80	3,84±0,76	*t* (185) =-3,70*
Information management capacity	SLD	3,07±0,69	3,11±0,81	*t* (56) =-0,17
	WLD	3,36±0,79	3,66±0,71	*t* (185) =-2,74*

* p<0,05 Note: SLD: Children with special learning difficulties, WLD: Children without special learning difficulties.

Discussion

The current study aimed to document the reference to the use of general knowledge strategies of cognition and special regulation strategies of cognition by Greek Elementary School students with and without learning difficulties.
According to the results of the study, it becomes evident that both groups use meta-cognitive learning strategies, and those which prevail concern the knowledge of cognition in relation to those associated with the regulation of cognition. Students without learning difficulties reported significantly higher use of metacognitive strategies compared to that of the students with special learning difficulties.

Despite the significant difference in the frequency of use which is reported by the students without learning difficulties in comparison to the students with special learning difficulties, this difference appears to reflect a quantitative difference, not a difference in depth with respect to the kind of metacognition used. Thus, differences emerge among students, which refer to the kind (knowledge and regulation of cognition) and similarities in the depth of metacognitive processing. The similarities that emerge between the two groups concern the use of strategic 'knowledge of cognition which acts as the central factor in the process. The common difficulty of the two groups concerns the metacognitive process in depth, the regulation of cognition, which is a higher hierarchically level of elaboration. The differences in the metacognitive profile of the two groups show that students without learning difficulties outweigh those with learning difficulties in the knowledge of cognition. Consequently, students without learning difficulties outclass the others in elements of cognition such as the declarative, procedural and episodic knowledge.

Knowledge of cognition versus regulation of cognition

In total, students, regardless of their learning difficulties, state that they mainly use strategies of knowledge of cognition and less strategies of regulation of cognition. Similar findings are also reported by Roussos, Koulianou & Samartzi (2016). During their research on the relationship between metacognitive knowledge and self-regulated learning they ascertained for the whole sample higher performance in the knowledge of cognition and lower performance in the regulation of cognition. Additionally, Aydin & Ubuz (2010) on applying Jr. MAI on a Turkish student population found a wider use of knowledge strategies of cognition versus regulation strategies. A development type interpretation cannot be given in our case since both younger and older students use metacognitive learning strategies more, which concern the knowledge of cognition in relation to those associated with the regulation of cognition.

More specifically, girls with special learning difficulties present lower scores in knowledge and the regulation of cognition, statistically significant, compared to the girls without special learning difficulties. The same is valid for the boys with and without special learning difficulties, although they present lower prices than girls. The above is in line with various studies, such as those of Botsas & Padeliadu (2003), Geladari & Mastrothanasis (2010), Geladari, Griva & Mastrothanasis (2010) and many others, which argue that children with special learning difficulties present a lower performance in the use of metacognitive strategies compared to other classmates of theirs.

Comparison between genders

Regardless of the existence of special learning difficulties, in this research, girls appear to use metacognitive strategies more frequently than boys. In the whole sample girls in relation to boys appear to make greater use of cognition regulation strategies and not the knowledge of cognition. According to Kolić-Vehovec, Bajsanski & Rončević (2010) "Metacognitive development in reading during this period is related to gender; as it was shown in the faster metacognitive development of girls compared to boys. However, the pattern of differences varies depending on the components of metacognition" (p. 328).

In a series of studies (Koli-Vehovec & Bajsanski, 2006; Kolić-Vehovec et al, 2010) researchers tried to compare whether findings obtained in Croatia would be similar in Slovenia, a neighboring country, with a similar language and schooling system.

The gender differences in metacognitive knowledge of reading strategies, as well as reading motivation, were examined in samples of 4th- and 8th grade students from Croatia and Slovenia. However, no differences on metacognition knowledge occurred between the boys in the Slovenian sample and the girls in the 8th grade, while boys in the Croatian sample still fell significantly behind girls. This difference was explained as a lack of motivation for reading exhibited by Croatian boys.

The reports about gender-related differences in metacognition occur in parallel with either significant differences in favor of females such as those of Ablard & Lipschultz, 1998; Carr & Jessup, 1997; Botsas & Padeliadu (2003), Geladari & Mastrothanasis (2010), Geladari, Griva & Mastrothanasis (2010), Vello, Rani & Hariharan (2015), in academic level students or insignificant differences according to Fennema, Carpenter, Jacobs, Franke & Levi, (1998); Lundeberg et al (1994), Padeliadou, Botsas, & Sideridis, (2002), Sperling, Howard, Miller, & Murphy, (2002) and Aydin & Ubuz (2010). According to Kolić-Vehovec et al. (2010) gender-based differences could emerge from educational practices that might not be equally beneficial for boys and girls.

Grade Comparison

In the current study we found similarities in the metacognitive profile of the 5th and the 6th grade as to the frequency of use of knowledge strategies of cognition versus the strategies of regulation of cognition. Students in both grades use more often metacognitive learning strategies related to the knowledge of cognition than those associated with the regulation of cognition. Researchers as Schraw and Dennison, (1994), Sperling et al. (2002), Baker (2005), Aydin & Ubuz (2010) support the view that differences in metacognition are caused in part by the differences in the grade level which are in favor of students of higher grades. However, in the research of Sperling et al. (2002) no differences in the use of strategies were found despite the initial assumption. In the research of Aydin & Ubuz (2010), there was a significant difference in the average among grade levels only on the scale knowledge of cognition. On the other scale, regulation of cognition, tenth grade students again had higher awareness of their regulatory processes; however, they did not appear significant. This may be because, as Baker (2005) has noted, students in upper elementary education are cognitively prepared for metacognitive improvement, but at the same time their intrinsic motivation for learning decreases.

In our research results revealed differences in metacognitive profile of the 5th and 6th grade. Sixth grade students show an increased report of usage of strategies of knowledge of cognition and regulation of cognition compared to the students of the fifth grade. But both aged groups prefer the usage of knowledge of cognition strategies versus regulation of cognition. There are several possible explanations for the obtained pattern of age differences in Jr. MAI (Kolić-Vehovec et al., 2010, 337). First, this pattern of differences could be in part due to motivational factors, including social desirability and the perceived value of studying, which is emphasized at younger ages. Second, in older students some aspects of strategic reading become automatic and are no longer under conscious control. Thus, lower ratings reflect a lack of awareness due to automatized processing rather than a lack of the use of reading strategies. Third, it is possible that younger students overestimate the frequency of strategy use as a consequence of their inadequate self-assessment. Fourth, younger students might use strategies more often but in an inefficient way.

Implication of Research Findings

The recording of the profile of the students with and without special learning difficulties opens the way both academically and searchingly for changes in the teaching planning. Students seem to use metacognitive strategies which are mostly limited to the knowledge of cognition, the declarative, procedural and casual knowledge of the individual and not to the regulation of cognition, planning, monitoring and control (Sperling et al., 2002). Thus, the integration of tools, such as the MAI Jr is considered essential before, during and in the end of each educational effort for both the students and the teachers.

The integration of metacognitive strategies in all stages of the educational process will enhance the cognitive efforts and performance of all students. Teaching should be understandable, gradual and focusing on all parameters of metacognition according to the developmental and special learning needs of the children (Mastrothanasis & Geladari, 2016).

Moreover, regardless of the special learning difficulties, the difficulty of the students to use higher level strategies of regulation of cognition opens up to the discovery of deficiencies in educational planning and creates the need for the development of these strategies in the classroom.

Recommendations for Further Research

Evidently, the necessity for a new direction in the teaching approaches is fashioned for students with or without learning difficulties. Furthermore, we need to know what kind of strategies of self-regulation students are taught in school (Veenman, Van Hout-Wolters & Afflerbach, 2006).

The findings show the importance of direct recording of the metacognitive profile of the teachers. Such future research will shed light on the kind of metacognitive strategies used by teachers in their daily teaching practice.

This research was carried out in a single region. Future research on a larger sample and a larger age range will shed more light on the use of metacognitive knowledge and regulation strategies at every age and in every region.

Furthermore, it is important to draw a systematic study of the way in which the transfer of strategies for students with special learning difficulties will be cultivated (SLD).

Brown, Armbruster & Baker (1986) mention that the knowledge of cognitive processes (first kind of metacognition) develops slowly, that is, the knowledge that previous information is important for the reading comprehension, how to use the preliminary strategies for the text inspection in order to detect their previous knowledge, when and why should they adjust their reading speed to achieve goals set for the specific reading intervention. Taking into consideration that the good readers develop their metacognitive abilities after the third grade of the primary school, while children with reading disabilities do the same thing after the sixth grade, the planning of teaching strategies should be investigated in order to meets the needs of the students.

In Greece students do not seem to understand the metacognitive strategies as a special kind of strategies (Kostaridou-Eukleidi, 2005). This happens either because students do not use metacognitive strategies widely or because they are not aware that they use them or that they had never been taught how to use them. It constitutes a mere conjecture which must be checked by means of research that if the educational system cultivates and requires their use regardless of the cognitive strategies, then students will be able to consciously apply them and thus develop an awareness of their different role.

Conclusion

The basic objective of this research was the investigation of the metacognitive strategies of the knowledge and regulation strategies of cognition of Greek students with and without special learning difficulties. Students without special learning difficulties seem to outclass in elements of cognition such as the declarative, procedural and episodic knowledge - high perception of self-efficiency. However, despite the differences in the frequency of use of metacognitive knowledge and regulation strategies of cognition both teams face difficulty in the metacognitive process in depth (cognition regulation of an upper hierarchical level of treatment).

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Acknowledgement

The post-doctoral research is part of IKY Scholarship program funded by the Action "Strengthening Post-doctoral Research from the resources of OP "Human Resources, Education and Lifelong Learning" Under Priority Areas 6,8,9 and financed by the European Social Fund, ESF, and the Greek Government.