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ASSESSMENT OF TEACHERS' METACOGNITIVE AWARENESS. VALIDATION AND APPLICATION OF METHODOLOGICAL TOOLS, IMPLICATIONS FOR PROFESSIONAL DEVELOPMENT

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Abstract: *The article presents methodological research in the field of metacognition, centered on the pre-testing and validation of a research instrument that will be applied in a cross-sectional study on teacher needs analysis. The training needs analysis is a part of the research of the doctoral dissertation "Development of metacognitive skills of primary and pre-school teachers". Given that in this research we intend to measure the level of metacognitive awareness of teachers in relation to their professional development and in order to approach the elements of metacognition in a unified way, we considered it useful to adapt two commonly used instruments for this purpose: the metacognitive awareness inventory for teachers, after Balcikanli, and the metacognitive awareness inventory for adults, after Schraw and Dennison. These instruments were pre-tested on a total of 195 primary and pre-school teachers. In this article, we present the research background, the process and results of the pretesting of the Adult Metacognitive Awareness Inventory -MAI (Schraw and Dennison,1994), which was adapted and developed according to the aims and context of the doctoral research The variables of the methodological research were defined and correlated according to the answers regarding: a) significant differences between the factors influencing the level of metacognitive awareness; b) obtaining positive and significant correlations between the factors and the dimensions of the MAI inventory. The obtained results were grouped in three parts represented by: a) item descriptive statistics; b) results of confirmatory factor analysis; c) descriptive analyses on metacognition dimensions and elements of inferential intergroup statistics. In this article, the results of the pretesting of the MAI inventory by means of inferential statistics are presented in detail. The statistical analyses confirm the validity of the adapted instrument, according to the metacognitive awareness inventory*

for adults - MAI (Schraw and Dennison, 1994), by its internal consistency and its relevance in assessing the level of metacognitive awareness of the subjects in the group of teachers selected for the doctoral research.

Keywords: *teachers' metacognitive competences; metacognitive skills development; metacognitive awareness assessment; metacognitive awareness inventory - MAI; self-management of professional development.*

Introduction

The development of metacognition is a desirable factor in the training and professional profile development in youth and adult education, with significant implications for career and spiritual profile development, in line with social values, professional standards and personal goals/expectations. In the field of professionalization of teaching careers and in-service teacher training, metacognitive competences are a topical issue in psycho-pedagogical research, educational policies and the reform of the initial and in-service teacher training system and curriculum

The extent to which teachers themselves are metacognitive is unclear, as there is not much research on teacher metacognition, but the development of metacognition could enable more effective professional development activities in this area. Georghiades (2004a) argues that those teachers who happen to be familiar with the notion of metacognition do not have the resources to implement it in their teaching (in terms of both appropriate learning materials and time). Thus, the current state of the literature in this area has already shown signs of an emerging gap between theory and practice: 'academic studies emphasize the value of metacognition for learning, but attempts to bring metacognition into mainstream classrooms are rare. If metacognition is to find its way into instruction, policy makers must make changes in curriculum and teacher training that facilitate it" (Zohar&Barzilai, 2013, p.7).

The development of metacognitive competences in teachers has an increased impact on both their teaching and the management of their professional development. Teachers need to be able to develop solid content knowledge by critically synthesizing and valuing different resources, adapting to changes in the educational system as well as to the varying demands of the beneficiaries of education. The ability to monitor and control one's own professional development effectively is essential for professional performance according to the teaching career standards.

In educational practice, teachers with metacognitive skills ensure that

they are able to develop professional development plans, monitor their teaching behaviors, regulate instruction, evaluate teaching performance, reflect on instructional activities and professional performance. These capacities and skills underpin the development of the teacher's metacognitive dimension, which is integrated into the desirable profile of professional competence and valorized in the management of one's own teaching career.

Conceptual and methodological foundations

Approached as a set of metacognitive knowledge, skills and experiences, metacognitive competences are highlighted by the ability to self-assess the level of professional development, awareness and self-analysis of training needs, by selecting, adapting and applying strategies for planning, monitoring and regulating their own training process. In teaching career management, metacognitive skills reveal the ability of teachers to use methods and techniques of self-analysis, in the sense of metacognitive strategies, self-reflection and self-regulation, but also in the process of self-regulated learning, essential for the professional growth of teachers throughout their careers. Recent research emphasizes the impact of metacognitive skills on teachers' professional performance (Fathima et al., 2014), by developing a meta-perspective on their in-service training activity as a prerequisite for effective self-management of professional development.

The assessment of metacognition has been a great research challenge over the years, especially because metacognition is a complex phenomenon that integrates interrelated variables of cognition, axiological system and personal experiences. The development and use of valid assessment tools has been an ongoing concern of researchers, who have emphasized that measuring metacognitive awareness in a given domain involves the use of metacognitive literature and research to develop a thorough understanding of metacognition, metacognitive processes and dimensions.

The assessment of metacognition is conducted in controlled settings, most commonly using a single scale-like instrument with clearly stated psychometric properties that measures a single dimension or several aspects of metacognition. However, Schraw (2000) emphasizes that no single research method or procedure can provide a complete understanding of a complex phenomenon such as metacognitive awareness. He believes that "most available instruments that measure metacognition have unknown psychometric properties" (Schraw, 2000, p. 301). Also, Hughes (2019) is of the opinion that single-method metacognition research measures metacognition superficially. For this reason, research using multiple, triangulated, and mixed-method approaches is recommended (Pintrich, Wolters & Baxter, 2000; Schraw,

2000, 2009).

Assessment of the level of metacognitive awareness in general and metacognitive skills of teachers for professionalization of teaching career is revealed in:

- the ability of diagnostic analysis of one's own level of development of professional competences, in relation to professional standards, personal expectations and the expectations of the beneficiaries of the educational act;
- capacities and skills of critical thinking, evidenced in self-analysis and reflection on competences and professional performance, asserted in educational situations or comprehensively reported at the level of professional development (Dumitru, 2013);
- the ability to elaborate a complex professional development project, focused on several elements: the vision of one's own professional development; the definition of strategic objectives of professional (self-)training; the proposal of training activities in order to acquire / improve desirable professional and transversal competences; the selection of strategies to make the implementation of the professional development project more efficient (managerial strategies, metacognitive strategies, professional learning situations;
- establishing forms and tools for evaluation/meta-evaluation of the professional development curriculum (Bunăiașu, 2013)
- self-regulation capacities of the vocational training process, through: self-observation, self-monitoring; self-judgement; self-reaction; self-attitude (Schunk, 1996).

In order to identify and analyze the level of metacognitive awareness as well as to develop metacognitive skills, Schraw and colleagues (2000) emphasized the importance of the following strategies (Henter, Indrieica, 2014):

- Observing metacognitive skills leads to insights about strategies, metacognition and motivation in academic tasks;
- Selecting appropriate cognitive tasks for using metacognitive skills;
- The use of instruments with psychometric properties appropriate to the various populations investigated;
- Using a variety of qualitative and quantitative methods for each topic.

The methods used to measure metacognition influence the aspects of metacognition that are captured in the resulting data. Thus, behavioral tracking methods can be used to measure some metacognitive skills, but are not as well suited for measuring knowledge. In contrast, interviews can be used to measure knowledge and beliefs, but are limited to processes that the interviewee knows and can recall.

Meyers and Paris (1978) were the first to create a metacognitive

inventory, corroborating the categories developed by Flavell and Welman (1977), namely person, task and strategy. Later, Paris and Jacobs (1984) modified Myers and Paris's (1978) instrument by using a questionnaire containing 15 open-ended questions across three factor categories: planning, evaluation, and regulation (Balcikanli, 2011). In 1990 in their empirical studies, Weinstein, Palmer, and Schultz (1987) and Pintrich and DeGroot developed two inventories commonly used in subsequent research on metacognition: the *Learning and Study Strategies Inventory* (*LASSI*) and the *Motivational Strategies for Learning Questionnaire* (MSLQ). The use of rating scales is one of the most common domain-independent measurement techniques that ask participants to self-report statements about cognitive processes. Schraw and Denisson (1994), on the other hand, developed a 52-item Likert-type self-report scale for adults, the *Metacognitive Awareness Inventory* (MAI), which measured both cognitive knowledge and cognitive regulation. Howard, McGee, and Shia (1999), correspondingly, generated a 32-item scale called *Inventory of Metacognitive Self-Regulation* (IMSR) to measure five factors related to awareness of learning processes and control of learning strategies: cognition knowledge, objectivity, problem representation and problem solving, task performance monitoring, and evaluation (Cihanoglu, 2012).

The assessment of teachers in the metacognitive domain is mostly carried out through metacognitive inventories, which are based on teachers' ability to self-identify their level of metacognitive awareness in relation to the activities they are involved in. The Metacognitive Awareness Inventory for Teachers - MAIT (Balcikanli,) and The Metacognitive Awareness Inventory (Schraw and Dennison, 1994) are the basic tools used in teacher research focused on the study of teachers' metacognitive training needs.

The assumption that these standardized instruments should be adapted and developed to the characteristics of the subjects and to the educational context variables constituted the elements of legitimacy underlying the objectives and methodological architecture of our study. The methodological design reveals the application of the principle of triangulation in the development and pretesting of the instruments of the cross-sectional study on the analysis of the training needs of primary and pre-school teachers in the field of metacognitive development.

In our article, we present the adaptation and development of the Metacognitive Awareness Inventory -MAI (Schraw and Dennison, 1994), as well as the process and results of pretesting and validation of this instrument. *The MAI* is a 52-item self-report instrument and each item is rated on a 5-point Likert-type scale ranging from "1 - Never Agree" to "5 - Always Agree" to report respondents' level of agreement with the statements. The items were categorized into eight sub-

components subsumed into two broader categories namely cognition of cognition and regulation of cognition (Schraw & Dennison, 1994).
In Schraw's model, the items of "cognition knowledge" were grouped into declarative knowledge (DK, knowledge about self and strategies, 8 items), procedural knowledge (PK, knowledge about using the procedure, 4 items) and conditional knowledge (CK, knowledge about when and how to use strategies 5 items), while the items of the "cognition tuning" component were grouped into: planning (P, goal setting, 7 items), strategy (S, implementation strategies, 10 items), monitoring (M, 7 items), debugging/regressing (D, error correction, 5 items) and evaluation (E, performance analysis, 6 items).

Research

Research study questions

The instruments for assessing the level of metacognitive awareness in teachers were selected from a theoretically sound framework and tested on samples with a large number of subjects. Even though there were different views on how to score the responses, which led to inconsistent scoring practices, the empirical evidence on the factor structure of the Metacognitive Awareness Inventory -MAI, pa that we will administer to teachers, can address this need by answering the following questions:

- Are there significant differences between the factors influencing the level of metacognitive awareness and between categories of subjects on the same criterion, revealed by the means obtained by applying the MAI inventory to primary and pre-school teachers?
- Can positive and significant correlations be obtained between the factors and dimensions of the MAI inventory?

The objectives of the methodological research are:

Adaptation of the metacognitive awareness inventory MAI (Schraw and Dennison,1994), by reformulating some items, to which are introduced variables specific to the matacognition and educational context of the selected categories of subjects.
Administering and validating the adapted MAI inventory in relation to its internal consistency and relevance as a research tool in the field of metacognitive skills assessment of primary and pre-school teachers.

Sample of subjects

The group of subjects was selected by stratified randomization technique, from the target population of primary and pre-school teachers to a representative sample. The structure of the sample of 195 teachers reveals several categories of subjects corresponding to subdivisions resulting from the application of three sampling variables, as follows

- according to the criterion of teachers' specialization, aiming to ensure a close percentage ratio: 93 teachers for pre-school

education and 102 teachers for primary education;

- according to the variable educational environment of the schools (urban/rural): 66 teachers from rural areas and 129 teachers from urban areas;
- according to the teaching grade obtained: 39 teachers with permanent grade, 75 teachers with teaching grade II and 81 teachers with teaching grade

Research results

Metacognitive Awareness Inventory (MAI), adapted from Schraw and Dennison (1994)

In this study, the aim of MAI was to collect quantitative data on participants' current level of metacognitive awareness, cognition cognition knowledge and cognition regulation. The inventory, which consists of 52 items, was adapted for professional development. The data were also used to compare sample groups by the variables: specialty, environment of residence, and teaching grade in terms of their level of metacognitive awareness. Schraw and Dennison (1994) indicated that MAI provided a "reliable baseline test of metacognitive awareness" when used in testing adults (p. 472). MAI has been identified as the test that has a reliable psychometric measure $\alpha = .90$ (Schraw & Dennison, 1994).

MAI consists of two main components, cognitive cognition and cognitive regulation. The factors of the proposed model are based on the eight-dimensional theoretical model, where DK = declarative knowledge (items 5, 10, 12, 16, 17, 20, 32 and 46), PK = procedural knowledge (items 3, 14, 27 and 33), CK = conditional knowledge (items 15, 18, 26, 29 and 35), P = planning (items 4, 6, 8, 22, 23, 42 and 45), IMS = information management strategies (items 9, 13, 30, 31, 37, 39, 41, 43, 47 and 48), M = monitoring (items 1, 2, 11, 21, 28, 34 and 49), DS = troubleshooting strategies (items 25, 40, 44, 51 and 52) and E. = evaluation (items 7, 19, 24, 36, 38 and 50). The eight sub-components of metacognition are rated at five levels of awareness: always true (5), sometimes true (4), neutral (3), sometimes false (2) and always false(1). On the lot investigated to pretest the instruments, the whole scale had an internal consistency coefficient of .780, and the internal consistency coefficient for the two dimensions described by the authors and adapted by rewording the items for teachers' professional development was .706 for Knowledge about cognition and .769 for Cognition regulation.

Case Processing Summary			**Reliability Statistics**	
Components/Dimensions	**N**	**%**	**Cronbach's Alpha**	**N of Items**

I. Knowledge about cognition	195	100,0	,706	17
II. Cognition regulation			,769	35
MAY			,780	52

Table 1. MAI reliability analysis

Varimax factor analysis identified a structure of eight factors that together explain 42.92% of the total variance. Items 2, 23, 40 although they had a higher saturation on the Metacognition Knowledge dimension, the Procedural Knowledge factor, were kept on the Cognition Adjustment dimension, the Planning and Troubleshooting/Regulation Strategies factors because their meaning allowed this while increasing the internal consistency of the latter factors.

Items	Factor saturations		Communalitie
	Knowledge about cognition	Cognition regulation	
1.Monitoring		,828	,821
2.Monitoring	,760	,643	,766
4.Planning		,823	,875
6.Planning	,721	,846	,831
7.Evaluation	-,635	,695	,758
8.Planning		,708	,743
9.Management Strategies	-,609	,699	,784
11.Monitoring		,673	,745
13.Management Strategies		,986	,992
19.Evaluation		,781	,828
22.Planning		,659	,836
23.Planning	,663	,731	,697
24.Evaluation		,797	,831
25.Debuggins Strategies		,685	,584
30.Management Strategies		,988	,992
31.Management Strategies		,735	,829
34.Monitoring		,705	,761
36.Evaluation		,792	,834
37.Management Strategies		,584	,770
38.Evaluation		,679	,653
39.Management Strategies		,758	,780
40.Debuggins Strategies	,690	,618	,824
41.Management Strategies		,986	,992
42.Planning	,601	,835	,936
43.Management Strategies		,644	,733

44.Debuggins Strategies		,728	,736
45.Planning		,776	,812
47.Management Strategies		,797	,868
48.Management Strategies		,820	,827
49.Monitoring		,680	,665
50.Evaluation		,880	,843
51.Debuggins Strategies		,787	,788
52.Debuggins Strategies		,880	,902
3.Procedural	,626	-,595	,772
5.Declarative	,541	,108	,706
10.Declarative	,733		,795
12.Declarative	,609		,813
14.Procedural	,855		,830
15.Conditional	,584		,743
16.Declarative	,621		,783
17.Declarative	,668		,736
18.Conditional	,875		,852
20.Declarative	,546	,506	,664
21.Monitoring			,748
26.Conditional	,774		,774
27.Procedural	,503		,731
28.Monitoring			,800
29.Conditional	,864	-,530	,836
32.Declarative	,627		,716
33.Procedural	,756	,666	,872
35.Conditional	,734		,759
46.Declarative	,947	,662	,936

Table 2. Factor analysis of MAI

Data analysis and interpretation of MAI inventory pretest results using inferential statistics

This section provides the results of inferential statistics, i.e. Independent samples t-test for independent samples and Pearson correlation. The details of each inferential statistic are aimed at: investigating the differences in metacognitive knowledge and metacognitive skills of teachers based on demographic variables, teaching position held and teaching grade, and the correlations between metacognitive factors in relation to professional development.

a)Independent samples t-test

The t-test was used to find any differences between the metacognitive dimension factors based on the independent variables.

Therefore, Table 3 explains that there is a significant difference between teachers' metacognitive knowledge and its subscales (i.e., declarative

knowledge, procedural knowledge, and conditional knowledge) based on the environment of residence when applying the MAI inventory: p = .001, p = .013, and p = .002, where p < .05.

Inventory	Factors	Residence environment				t	df	sig
MAI	Declarative	4,1818	,34333	4,0727	,25708	2,495	193	,013
	Procedural	4,0114	,34371	3,8140	,39066	3,474	193	,001
	Conditional	4,1182	,37289	3,9767	,25326	3,126	193	,002

Table 3. Independent samples t-t-test between teachers' metacognitive knowledge and residential background for MAITPD and MAI

The T-test was also applied to the teachers' teaching function variable and significant differences were observed between the results obtained by pre-school and primary school teachers on the items attributed to the declarative knowledge factor (MAI): p = .005, where its value p < 0.05 (Table 4).

Inventory	Factors	Teaching function				t	df	sig
MAI	Declarative	4,0484	,27401	4,1654	,29963	-2,838	193	,005
	Procedural	4,1654	,29963	3,8971	,36620	-,616	193	,539
	Conditional	4,0323	,28020	4,0176	,32834	,333	193	,740

Table 4. Independent samples t-test between teachers' metacognitive knowledge and teaching function for MAI

In Table 5 we can observe the differences between teachers with a permanent teaching degree, those with a teaching degree II and teachers with a teaching degree I: there are significant differences for all factors corresponding to Metacognitive knowledge: p = .002, .000, where p < 0.05.

Inventory	Factors	Teaching grade						df	sig
		definitively		Grade II		grade.I			
		M	SD	M	SD	M	SD		
MAI	Declarative	4,0481	,28765	4,1350	,27781	4,1157	,30795		,315
	Procedural	3,6923	,49823	3,9100	,39558	3,9444	,27670		,002
	Conditional	3,8923	,24643	3,9920	,29854	4,1185	,31109		,000

Table 5: Independent samples t-test between teachers' metacognitive

knowledge and teaching grade for MAITPD and MAI

Table No. 6 explains that there is no significant difference between teachers' metacognitive skills and its subscales (i.e., planning, management strategies, monitoring, troubleshooting/regulation strategies, and evaluation) based on the environment of residence when applying the MAI inventory. We find a significant difference for: planning skills p = .004, management strategies p = .001 and monitoring strategies p = .018, where p < .05.

Inventory	Factors	Residence environment				t	df	sig
MAI		rural		urban				
		M	SD	M	SD			
	Planning	3,9351	,56043	3,7575	,28772	2,927	193	,004
	Management	4,2576	,22743	4,1395	,24067	3,301	193	,001
	Monitoring	3,6494	,45672	3,5183	,30466	2,386	193	,018
	Debugging	3,7000	,48895	3,7535	,31475	-,924	193	,356
	Evaluation	3,6288	,29928	3,6550	,30276	-,807	193	,422

Table No 6 Independent samples t-test on the factors of the dimension metacognitive abilities of teachers and their residence environment for MAI

Table 7 makes it clear that there is a non-significant difference between the metacognitive regulation skills of pre-school teachers and the metacognitive regulation skills of primary school teachers and their subscales: information management strategies - p = .163 and evaluation - p = .320 > 0.05. In contrast to this the results table also shows that there is a significant difference between pre-school teachers and primary school teachers in terms of career path monitoring skills - p= .001, regulation strategies - p= .013), where the value of p< .05.

Inventory	Factors	Teaching function				t	df	sig
		prof_inv_preschool		prof_inv_primary				
		M	SD	M	SD			
MAI	Planning	3,7327	,35134	3,8950	,44223	-2,819	193	,005
	Management	4,1541	,27169	4,2026	,21059	-1,400	193	,163

	Monitoring	3,4700	,33475	3,6471	,37700	-3,454	193	,001
	Debugging	3,6645	,43154	3,8000	,31965	-2,506	193	,013
	Evaluation	3,6237	,29478	3,6667	,30669	-,996	193	,320

Table 7: Independent samples t-test on the factors of teachers' metacognitive skills dimension and teaching function for MAI

Data analysis demonstrates (Table 8) that there is a non-significant difference between teachers' metacognitive regulation skills and its subscales (planning, information management strategies, monitoring) based on the teaching grades held, only in the use of regulation strategies, p = .036 and evaluation skills, p = .028.

Inventory	Factors	Teaching grade						df	sig
MAI		definitively		grade.		grade.I			
		M	SD	M	SD	M	SD		
	Planning	3,8132	,30243	3,8229	,41540	3,8148	,44917		,990
	Management	4,1709	,28138	4,1778	,18448	4,1852	,27046		,953
	Monitoring	3,5495	,29412	3,5657	,33416	3,5661	,42764		,969
	Debugging	3,8000	,28654	3,7920	,38406	3,6519	,40838		,036
	Evaluation	3,6667	,19868	3,7067	,36540	3,5802	,26367		,028

Table 8: Independent samples t-test on the factors of the dimension metacognitive skills of teachers and teaching grade for MA

b) Pearson correlation (Pearson r)

In order to determine the level of interdependence or the degree of relatedness between the metacognition dimensions, as well as between the factors of these dimensions, we used Pearson's correlation coefficient r (linear correlation coefficient).

Analysis of correlations between metacognitive dimensions for the MAI inventory reveals a strong and significant positive relationship between metacognitive knowledge and metacognitive self-regulation skills of teachers as r = .618 and p = .000

MAI correlations

	Knowledge.of.cognition	Regulation.of.cognition

Knowledge.of.cognition	Pearson Correlation	1	,618**
	Sig. (2-tailed)		,000
	N	195	195
Regulation.of.cognition	Pearson Correlation	,618**	1
	Sig. (2-tailed)	,000	
	N	195	195

**. Correlation is significant at the 0.01 level (2-tailed).

Table 9. Correlation between metacognitive knowledge, metacognitive self-regulation skills of teachers

The correlational analysis between the factors of the MAI inventory revealed that there are positive, significant correlations between most of the factors, only between the management strategies factor and the rest of the factors there are positive insignificant correlations: r = .069, .019, .114, .103, .067, .055, with the significance threshold value ranging between .112 and .793.

Correlations

		Declarative	Procedural	Conditional	Planning	Management	Monitoring	Debugging	Evaluation
Declarative	Pearson Correlation	1	,266**	,531**	,493**	,215**	,481**	,464**	,274**
	Sig. (2-tailed)		,000	,000	,000	,003	,000	,000	,000
	N	195	195	195	195	195	195	195	195
Procedural	Pearson Correlation	,266**	1	,366**	,331**	,069	,199**	,209**	,056
	Sig. (2-tailed)	,000		,000	,000	,336	,005	,003	,433
	N	195	195	195	195	195	195	195	195
Conditional	Pearson Correlation	,531**	,366**	1	,563**	,019	,521**	,416**	,280**
	Sig. (2-tailed)	,000	,000		,000	,793	,000	,000	,000

	N	195	195	195	195	195	195	195	195
Planning	Pearson Correlation	,493**	,331**	,563**	1	,114	,569**	,470**	,308**
	Sig. (2-tailed)	,000	,000	,000		,112	,000	,000	,000
	N	195	195	195	195	195	195	195	195
Management	Pearson Correlation	,215**	,069	,019	,114	1	,103	,067	,055
	Sig. (2-tailed)	,003	,336	,793	,112		,151	,356	,448
	N	195	195	195	195	195	195	195	195
Monitoring	Pearson Correlation	,481**	,199**	,521**	,569**	,103	1	,502**	,411**
	Sig. (2-tailed)	,000	,005	,000	,000	,151		,000	,000
	N	195	195	195	195	195	195	195	195
Debugging	Pearson Correlation	,464**	,209**	,416**	,470**	,067	,502**	1	,414**
	Sig. (2-tailed)	,000	,003	,000	,000	,356	,000		,000
	N	195	195	195	195	195	195	195	195
Evaluation	Pearson Correlation	,274**	,056	,280**	,308**	,055	,411**	,414**	1
	Sig. (2-tailed)	,000	,433	,000	,000	,448	,000	,000	
	N	195	195	195	195	195	195	195	195

**. Correlation is significant at the 0.01 level (2-tailed).

Table 9 Correlation between the factors of metacognitive knowledge and metacognitive self-regulation skills in teachers for the MAI inventory

Discussion

In the present study we were primarily interested in adapting, experimentally testing and validating the Romanian versions of instruments to identify the level of metacognitive knowledge utilization and metacognitive skills based on the metacognitive experiences of primary and preschool teachers in relation to the management of their

teaching career. The authors of the original instruments do not specify the relationship between the subscales of the instrument, but given that they aim to assess intercorrelated elements of metacognition, we assumed that they would develop positive correlations. As a result we opted for a Varimax rotation with Kaiser normalization. What can be seen is that there are a few items that present problems due to the degree of saturation in two factors. In order to be able to interpret the obtained factors, these items have been kept on the factor where they presented a higher saturation. In general, for the definition of the factors and metacognitive dimensions respectively, a saturation of at least 0.30 is considered to be sufficiently important, considering also the variance of the respective variable that is explained by that factor. At the same time, the factor loadings in relation to the sample size of 195 teachers show good values at the significance threshold $p<0.01$, according to Stevens (2002) who states that for 200 subjects the minimum loading is 0.364.

In the MAI inventory, we also obtained negative saturations on some factors: factor 7 (*I know my level of professional skills development when I complete a continuing education program*.) shows a negative saturation of -0.635 on the dimension knowledge about cognition and a positive saturation of 0.695 on the dimension cognitive tuning; factor 9 (*I adapt the pace of learning according to the complexity of the training situations.)* obtained a negative saturation of -0.609 on the dimension knowledge about cognition and a positive saturation of 0.699 on the dimension cognitive tuning. Negative saturation was also found for item 3 (*I try to use, in particular, ways of professional development that I have used in the past.*) and 29 (*I use my intellectual strengths to compensate for my weaknesses*.), but they were kept on the dimension where they obtained positive saturations. One explanation for obtaining these negative saturations is that the items were rated inversely on the given dimensions. Given that the factor loadings and the obtained communalities are high, it means that the analyzed factor model is stable after fitting the original inventories.

The conclusion from the factor analysis is that the grouping of items into factors is approximately identical to that of the original inventories, and that the saturations of items in factors represent positive correlations between items and factors, respectively dimensions of metacognition. The obtained results confirm that the inventory adapted to measure the level of metacognitive awareness of teachers presents high validity in identifying the level of use of metacognitive skills in the management of teaching career.

By applying the T-test and ANOVA test we obtained results showing significant differences classified as follows:

- Metacognitive knowledge: for the variables residence background, teaching function and teaching grades, although teachers scored

high and medium, there were significant differences between the means obtained by rural and urban teachers for all metacognitive knowledge factors;

- metacognitive skills: there are significant differences on the factors of planning, information management strategies and monitoring between the scores obtained by rural and urban teachers; between pre-school and primary school teachers there are significant differences obtained for the factors of planning, monitoring, regulation and evaluation; for the variable teaching grades, mean scores were obtained without significant differences for the use of metacognitive skills in the professional development of teachers.

Inferential statistics, by calculating the Pearson linear correlation coefficient we obtained data that emphasize the existence of significant and strong positive correlations between the dimensions of metacognitive competence. There are also significant positive correlations between metacognitive knowledge factors and metacognitive ability factors, as well as between factors of the same dimension.

Conclusions

In institutional contexts, metacognition and self-management of professional development are considered competencies of particular importance for lifelong learning and career success. Metacognitive cognition, metacognitive control and metacognitive experiences, the three components of metacognition, are assessed by two metacognitive awareness inventories adapted on the dimension of teachers' professional development, following Schraw and Dennison(1994) .

The aim of the investigative approach was to adapt and validate the Metacognitive Awareness Instrument -MAI, by estimating all dimensions of teachers' metacognition in the process of professional development. The instrument was adapted for teachers to self-assess their level of metacognitive knowledge and metacognitive experiences related to teaching career management, planning skills, including monitoring of their professional development pathway in relation to professional standards. Teachers who score high in metacognitive development might be able to adjust their professional development activities over time according to their training needs; teachers can adjust their planning, monitoring and control strategies in a timely and dynamic manner to optimize and facilitate their teaching career development.

Accordingly, the Metacognitive Awareness Inventory -MAI, validated as a research tool in the field of metacognitive teacher development, will benefit teachers by enhancing the metacognitive dimension and increasing professionalism. The availability of these valid multi-faceted teacher metacognition scales may also have important practical

implications for the process of in-service teacher education. Typically, most current in-service teacher education programs tend to focus on the development of cognitive and methodological skills on the one hand, and cross-curricular skills on the other. There are programs on classroom management, educational leadership, effective communication, emotion management. However, the metacognitive dimension in the professional development of teachers is poorly represented in the training on offer.

The Metacognitive Awareness Inventory - MAI can help trainers to design concrete and functional curriculum structures for teacher training and lead to the formulation of more individualized guidance to improve teachers' self-regulated learning. Trainers can track the level of active engagement of trainee-teachers through peer observation (Tenenberg, 2016), using the instrumental as an analytical framework to discriminate their behaviors in the training program to guide them in appropriate ways to develop the targeted competencies.

Metacognitive intervention strategies, such as planning, monitoring and evaluation, can improve teaching career management competence (Fathima et al., 2014). The Metacognitive Awareness -MAI tool can be used to self-explore the different characteristics of metacognition in teachers, and subsequently, teachers can carry out a professional development project by formulating clear strategic goals and establishing more targeted in-service training programs to make professional development more purposeful and effective.

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