Metacognition Proficiency Scale Designed For Preschool Educators (MEPS)

Ela Sümeyye Seçim[1] Ensar Yıldız[2]

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Abstract
Through social transfers and adult-provided surroundings, children learn through observation and experience. The foundations of many skills are established throughout the preschool years. During this time, instructors' knowledge, abilities, and competences become more significant because they are important for children's skill acquisition in alongside formal schooling. The purpose of this study was to establish a reliable and strong instrument for assessing preschool instructors' metacognitive abilities. Convenience sampling was used to gather data from 414 preschool teachers using the survey methodology. The data was analyzed using Jamovi version 2.4.8, and SPSS 24.0 package packages. The validity of the construct was determined by applying factor analysis, both confirmatory and exploratory; content validity was tested through the application of the Lawshe Technique. Cronbach alpha values, item difficulty, item discrimination, and reliability were measured. The study led to the development of the Metacognition Proficiency Scale for Preschool Teachers (MEPS), which has 16 items, three dimensions (metacognitive competence, metacognitive knowledge, and metacognitive support), a Cronbach's alpha value of.75, and 77.817% of the total variance explained.

Keywords: Metacognition, metacognitive competence, metacognitive knowledge, metacognitive support, preschool teacher

[1] Corresponding Author, secim.1@osu.edu, The Ohio State University, Ohio, USA

[2] Author, Sivas Cumhuriyet Universty Faculty of Education, Sivas, Türkiye

Introduction

Research related to childhood care and education emphasizes how crucial the involvement of adults and the importance of adult-child interactions are to children's future development, learning, and achievement (Melhuish, 2016; Melhuish, Gardiner & Morris, 2017). Teachers are individuals who have a critical role in helping children acquire skills and behaviors and reinforcing these skills and behaviors (Başaran, 1994; Ocak, 2010). Teachers' knowledge and experience directly affect the learning experiences of the children they interact with and the skills that children will acquire. For this reason, teachers' knowledge and experience, as well as the skills they exhibit in teaching practice, are of vital importance. Teachers are adults who should have in-depth knowledge and skills related to the subjects they teach (Shulman, 1986). For example, they need to have skills in various areas such as problem solving (Erden & Akman, 2014), critical thinking (Korkmaz, 2009), effective communication (Lubis, Mesiono, Azhar, Faisal, & Kholid, 2023; Mesiono, Latif, Siti Rahma, Dermawan, & Elfin, 2023), knowledge management and managing learning processes. In this context, metacognitive skills, i.e. skills involving the integration and management of different skills, are of particular importance. Therefore, the qualities of professionals working with preschool children need to be examined and understood in detail. In this way, it is possible to contribute to the educational and developmental processes of children.

Metacognition Skills

Metacognition involves the active monitoring and structuring of one’s own fundamental cognitive processes and information (Flavell, 1979; Metcalfe & Kober, 2005). However, metacognition skill is a complex construct. One of the main challenges faced by researchers working on metacognition skill is the need to unify the terms that can be used to explain this term (Zohar & Barzilai, 2013). In other words, since metacognition skill includes many skills, researchers need to integrate many other terms and concepts while defining it. For this reason, different scientists define metacognition skill in different ways. Flavel et al. (1999) define metacognition as a set of cognitive activities that have a purpose or adjust some aspect of any cognitive attempt. Sternberg and Davidson (1983) define it as managerial processes at a higher level of consciousness. Schraw and Moshman (1995) describe metacognition as the self-awareness of one's cognitive processes and the capability to assess and structure information effectively. Similarly, Brown (1987) defines metacognition as the ability to think about and evaluate one's own learning processes. In simple terms, it is possible to define metacognition as the ability to observe one's cognitive activities while in the learning process and the ability to interpret and direct cognitive activities within oneself. Schraw and Moshman (1995) explained metacognition particularly through three fundamental skill areas that regulate teachers' cognitive processes: declarative knowledge (knowing what is done), procedural knowledge (knowing how to do it), and conditional knowledge (knowing when to use which knowledge). These three areas are critically important for teachers to organize, monitor, and control their instructional practices in the classroom (Schraw & Moshman, 1995).

Scientific studies have demonstrated that a wide range of factors influence the existence of metacognition skills. Family (Marliyani & Suradijono, 2019; Rani & Duhan, 2020), gender (Topcu & Yılmaz-Tüzün, 2009), educational status (Maric & Sakac, 2020) and teachers (Carr et al., 1989; Soodla, Jõgi & Kikas, 2017) are just some of these variables. Metacognition is a skill that can be taught at an early age (Chatzipanteli et al., 2014), and it is concluded that the metacognition skills of students in the class of teachers who have metacognition skills are higher compared to other students (Soodla, Jõgi & Kikas, 2017).

Turkey’s preschool education policies prioritize the development of fundamental skills in early childhood and emphasize establishing the foundations for lifelong learning. The Ministry of National Education’s (MEB) Preschool Education Program (2013) not only fosters children’s cognitive, social-emotional, and language development but also explicitly aims to enhance their thinking skills. Correspondingly, the competencies expected of teachers are delineated in the MEB Teaching Professional Standards (2017), which highlight the crucial role of educators in monitoring, assessing, and facilitating children’s learning processes. Within this framework, supporting metacognitive skills is essential, as it enables children to become aware of and regulate their own learning. Given that core

21st-century skills—such as self-regulation and problem-solving—are grounded in metacognitive awareness, the assessment and cultivation of these skills during early childhood is vital and directly aligned with the objectives of national educational policies (MEB, 2013; MEB, 2017). Teachers' advanced metacognitive skills directly support the development of students' self-regulated learning skills (Zimmerman, 2002). Self-regulated learning is the process of individuals identifying learning goals, selecting appropriate strategies, monitoring the learning process, and adjusting strategies as needed. By modeling these skills, teachers instill in children the habit of questioning their thoughts and managing their learning processes. Thus, metacognitive awareness guides teachers' pedagogical practices in both planning, implementation, and evaluation stages, facilitating in-depth student learning (Veenman, Van Hout-Wolters, & Afflerbach, 2006).

Consequently, identifying teachers' metacognitive skills and supporting them according to their needs should be a priority goal in educational policies and teacher training programs, as it contributes to the development of children's higher-order cognitive skills, such as critical thinking, problem-solving, and self-regulation, in preschool education. In this context, the need for systematic assessment of preschool teachers' metacognitive skills is increasing. However, the literature demonstrates a limited number of contextually valid and reliable assessment tools that can meet this need.

Current Measurement Tools about Metacognition

Metacognitive Awareness Inventory (MAI) is a 52-item scale developed to assess individuals' metacognitive awareness levels (Schraw & Dennison, 1994). It is structured into two main dimensions: knowledge about information (declarative, procedural, conditional) and cognitive regulation (planning, monitoring, evaluating, debugging, information management). However, The MAI was developed with university students and adults and is not directly related to teaching-specific tasks or classroom pedagogical practices. It does not provide sufficient depth to understand teachers' use of cognitive strategies in the preschool context.

Teachers' Metacognitive Knowledge Questionnaire (TMKQ) aims to assess teachers' conceptual knowledge regarding metacognition and their capacity to reflect this in their teaching processes (Veenman et al., 2006). It focuses primarily on measuring the theoretical knowledge of pre-service teachers or individuals in the teacher education process. Therefore, it falls short of assessing active preschool teachers' use of strategies integrated with classroom practice.

Metacognitive Strategies in Teaching Scale (MSTS) aims to assess the metacognitive strategies teachers use in the teaching process (Kaya & Yıldız, 2019). Nevertheless, this scale was designed primarily for secondary and high school teachers. It focuses on processes such as conceptual transfer, questioning, and evaluation within the teaching process, and does not include approaches such as observation, play-based learning, and indirect instruction, which are more common in early childhood education.

Metacognitive Awareness Scale for Teacher Candidates (MASTC): Adapted from the MAI by Akın, Abacı, and Çetin (2007), the MASTC was developed to assess preservice teachers' levels of metacognitive awareness.

Preservice Teachers' Metacognitive Skills Scale (PTMSS): Developed by Tuncer and Kaysi (2013), the PTMSS is designed to measure preservice teachers' metacognitive skills across three dimensions: planning, monitoring, and evaluation.

All the scales outlined above either do not target preschool teachers or do not adequately reflect the pedagogical and contextual characteristics of early childhood education. Preschool teachers' metacognitive skills generally include specific skills such as planning play-based learning environments, making strategic decisions considering children's developmental differences, and guiding learning processes through structured observation and reflective thinking. In this context, existing measurement tools have limitations in terms of validity and application because they are not structured appropriately to the nature of the preschool context. Therefore, the development of a new measurement tool that can multidimensionally assess preschool teachers' metacognitive skills directly related to classroom practices, is integrated with pedagogical practices, is culturally sensitive, and aligns with the structural characteristics of early childhood education is essential. This developed scale will reveal the extent to which teachers consciously plan, monitor, and evaluate their teaching practices, while also contributing to the needs-based design of professional development programs.

Purpose of the Study

A review of global research highlights the crucial role of teachers' metacognitive knowledge and identifies the availability of various tools designed to evaluate their metacognitive skills (Schneider 2008; Spor & Schneider 1999; Spor & Schneider, 2001; Zohar, 2006). However, when the national literature is examined, it is concluded that studies on the subject are limited. Therefore, the aim of this study is to create a trustworthy and valid instrument for evaluating the metacognitive knowledge and competencies of preschool teachers. The objective of this study is to develop a valid and reliable scale to measure the metacognitive efficacy of preschool teachers in Türkiye. The research question of the study aims to address is:

Is the Metacognition Proficiency Scale Designed For Preschool Educators a valid and reliable measurement tool?

Method

A survey design was used in this study to determine the relationships between the variables. In the survey design, it is aimed to present the researched situation as it exists. In survey studies, researchers focus on the how question rather than the why question (Fraenkel & Wallen, 2009).

Study Group

In this study, the convenience sampling method was employed. This method is advantageous for researchers due to its cost-effectiveness, ease of access, and practical applicability (Fraenkel & Wallen, 2009). Using this approach, a total of 414 preschool teachers were reached, allowing the researchers to collect data efficiently in terms of both time and resources. Initially, face-to-face data were collected from 279 participants for the Exploratory Factor Analysis (EFA). Subsequently, using the same sampling strategy, an additional 135 participants were reached through face-to-face data collection for the Confirmatory Factor Analysis (CFA). For scale development research, it is suggested that the sample size be around ten times the total number of items (MacCallum et al., 2001) or 300 people is good for the sample size (DeVellis, 2014; Tabachnick & Fidel, 2007). Accordingly, it can be said that the sample size is sufficient. The demographic characteristics of the preschool teachers who comprised the study group were as follows: 94 were male and 320 were female, with a mean age of 29.72 years and an average of 8.65 years of professional experience. Regarding educational background, 296 participants held a bachelor's degree, while 118 had a graduate degree.

Data Collection Process

In the process of developing the Metacognition Proficiency Scale (MEPS), researchers began by conducting an extensive literature review and then created an initial pool of 35 items designed to assess metacognition proficiency. These items were rated using a 3-point Likert scale (1 = Disagree, 2 = Moderately Agree, 3 = Agree), which was deliberately chosen due to its practical and cognitive advantages, especially when working with professionals like preschool teachers who often have limited time and high workloads. Three-point Likert scales offer several benefits: they encourage clearer and more decisive responses by minimizing ambiguity (Jacoby & Matell, 1971), reduce indecision and shorten response time (Krosnick & Presser, 2010), and decrease cognitive load, which is particularly beneficial in studies involving participants with demanding schedules (Adelson & McCoach, 2010). Therefore, the use of a three-point scale allowed participants to respond more quickly and confidently, ensuring efficiency and clarity in data collection.

To assess content validity, the item pool was sent individually via email to 14 experts, including 7 specialists in early childhood education, 3 experts in educational measurement and evaluation, and 4 researchers with experience in metacognition. Using the Lawshe technique, expert feedback led to the elimination of 10 items not considered directly relevant to the metacognition construct—such as Item 13 (“I allow children to observe their peers during activities”), Item 31 (“I allow children to correct their peers’ work during activities”), and Item 32 (“I allow children to guide their peers during activities”)—resulting in a refined pool of 25 items.

To test clarity and comprehensibility, a trial application was conducted with three preschool teachers. Based on positive feedback, a pilot study was subsequently conducted with 108 preschool teachers. Statistical analyses were carried out to calculate item difficulty and discrimination indices. Although item difficulty is traditionally used for dichotomous items, in Likert-type scales, the item mean serves as an indicator: values close to 2.0 suggest moderate endorsement, whereas values above 2.5 may indicate ease or strong agreement, and values below 1.5 may reflect difficulty or lack of endorsement (Tavşancıl, 2022; DeVellis & Thorpe, 2021). Item discrimination was evaluated through corrected item-total correlations. Following standard thresholds, items with correlations above .40 were considered highly discriminative, while those below .20 were deemed weak (Büyüköztürk, 2022; Field, 2018). Based on these criteria, 9 items were removed due to discrimination indices below .20 and difficulty values between .80 and 1.00.

The final version of the MEPS scale consisted of 16 items. For the main application, data were collected from 279 preschool teachers for Exploratory Factor Analysis (EFA) and 135 preschool teachers for Confirmatory Factor Analysis (CFA). Following these analyses, the scale's sub-dimensions were identified and named. The streamlined 3-point Likert structure not only supported statistical analysis but also enhanced the feasibility and usability of the scale for educators working in time-constrained, high-demand environments.

Data Analysis

Descriptive statistics and item analyses were conducted using the SPSS 24 statistical software package. In addition, Exploratory Factor Analysis (EFA) was performed within the same program using the principal components method, and the Varimax rotation technique was selected as one of the orthogonal rotation methods. Subsequently, a Confirmatory Factor Analysis (CFA) was performed to test the factor structure of the scale based on a theoretically grounded model. This analysis was carried out using Jamovi version 2.4.8, specifically employing the SEMLj module (Structural Equation Modeling via lavaan), which operates on the R-based lavaan package (Rosseel, 2012) and allows users to perform structural equation modeling through a user-friendly graphical interface. Since all variables in the model were ordinal, the Diagonally Weighted Least Squares (DWLS) estimation method was used. Standardized factor loadings obtained from the CFA were examined to assess the item–factor relationships, the presence of any cross-loadings, the statistical significance of the loadings, and indicators of construct validity.

Validity and Reliability

For the content validity study, 14 experts were consulted using the Lawshe Technique. Accordingly, ten items in all were taken off the scale, because the content validity criterion for 14 experts was not between .51-1 (Veneziano & Hoper, 1997; as cited in Yurdugül, 2005).

The overall content validity index (CVI) of the scale, calculated as the average of the CVR values for the 25 retained items based on evaluations from 14 experts, was found to be .827, indicating a high level of agreement among experts and strong content validity for the scale (Polit, Beck, & Owen, 2007).

Researchers conducted EFA and CFA to confirm construct validity. The total variance explained of the MEPS was calculated as 77.817%. Cronbach alpha values are used in internal consistency reliability estimations (Atılgan, 2019; Bademci, 2011). The Cronbach's alpha coefficients were calculated as .81 for the overall Metacognition Proficiency Scale (MEPS); and for its subdimensions: .962 for Metacognitive Knowledge, .938 for Metacognitive Competence, and .816 for Metacognitive Support. According to George and Mallery (2003), Cronbach's alpha values between .60 and .70 are considered acceptable, between .70 and .90 are considered good, and values above .90 are interpreted as excellent. To further evaluate the construct validity of the Metacognition Proficiency Scale for Preschool Teachers, a known-groups comparison was conducted based on participants' educational backgrounds. It was hypothesized that preschool teachers with graduate-level education would demonstrate higher levels of metacognitive proficiency than those holding only an undergraduate degree, considering their more extensive exposure to academic and professional training. An independent samples t-test was performed to test this hypothesis. The results revealed no statistically significant difference between the two groups, $t_{(277)} = -0.393$, $p = .694$. The mean scores of the two groups were highly comparable, and the 95% confidence interval for the mean difference included zero, suggesting no practically meaningful difference in metacognitive proficiency levels based on formal education. These findings indicate that the construct assessed by the scale does not appear to be strongly influenced by educational attainment, supporting the generalizability and measurement invariance of the scale across diverse teacher profiles. This result strengthens the evidence for construct validity, suggesting that the scale reliably captures the targeted metacognitive proficiency regardless of teachers' formal academic background.

Table 1.
Content Validity Ratios (CVR) Based on Lawshe Technique

Item No	Number of Experts Indicating "Essential"	Total Number of Experts (N)	CVR
m1	14	14	1
m12	14	14	1
m23	14	14	1
m4	14	14	1
m5	14	14	1
m16	14	14	1
m27	13	14	1
m8	13	14	1
m29	13	14	1
m30	13	14	1
m11	12	14	1
m19	12	14	0.857
m33	12	14	0.857
m34	12	14	0.857
m15	11	14	0.857
m6	11	14	0.714
m17	11	14	0.714
m18	11	14	0.714
m19	11	14	0.714
m20	11	14	0.714
m21	10	14	0.571
m22	10	14	0.571
m23	10	14	0.571
m24	10	14	0.571
m35	10	14	0.571
m26	10	14	0.429
m7	10	14	0.429
m28	10	14	0.429
m9	10	14	0.429
m10	10	14	0.429
m31	10	14	0.429
m32	10	14	0.429
m13	9	14	0.256
m24	9	14	0.256
m25	9	14	0.256

Findings

Information about the analysis of the Metacognition Proficiency Scale for Preschool Teachers (MEPS) is given below. First, normality analysis was conducted through, which is an essential phase in order to do EFA and statistically determine if the sample size is acceptable. Table 2 presents the analysis's results.

Table 2.
Results regarding Sampling and Normality Tests for MEPS

Kaiser-Meyer-Olkin (KMO) Sampling Adequacy Measure		.880
Bartlett Test of Sphericity	Approximate Chi Square	3991.515
	Sd	120
	Significance	< .001

Examining Table 2, KMO measure of sampling adequacy generated a result of 0.880. According to this value, it can be stated that the sample size is sufficient (Comrey & Lee, 2013; Şencan, 2005). The data are normally distributed because the Barlett Sphericity test outcome is statistically significant at the p<.05 level (Çokluk et al., 2012), a value of < .001 was obtained as a result of the analysis and since the normal distribution condition is met for this data set, EFA can be performed.

Table 3.
Table of Common Variances for MEPS

Items	Initial Values	Extraction
m1	1.000	.854
m2		.892
m3		.825
m4		.836
m5		.861
m6		.809
m7		.922
m8		.900
m9		.871
m10		.613
m11		.632
m12		.685
m13		.680
m14		.628
m15		.727
m16		.714

When Table 3 is examined, the common variances of the items vary between .613-.922. No item was removed because the cut-off scores were not below .30 (Büyüköztürk et al. 2014).

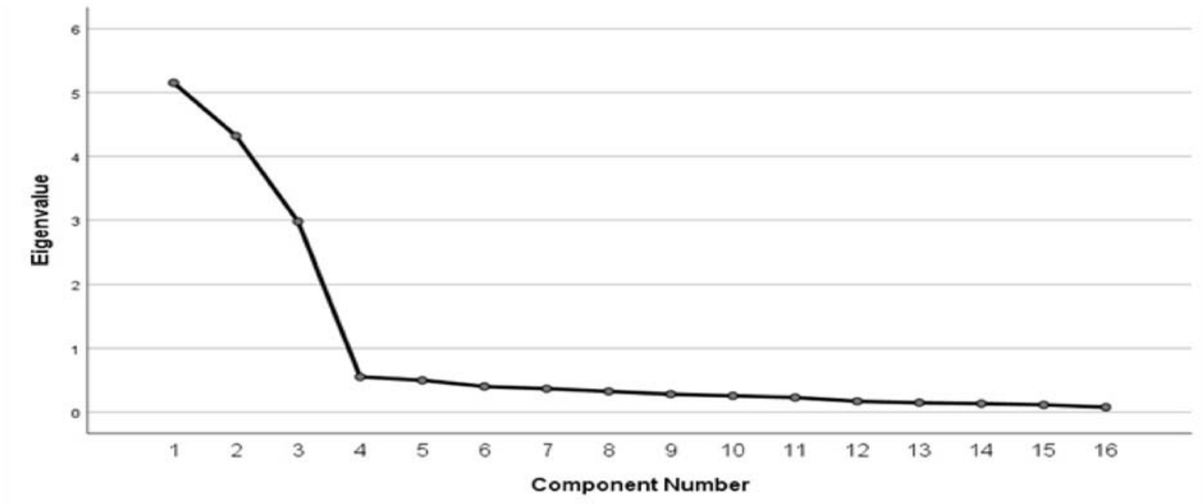

Figure 1. Scree Plot

When analyzing the slope accumulation graph in Figure 1, it is seen that the eigen values fall below the value of 1 after the third dimension. In light of this, it can be claimed that the scale has three sub-dimensions.

Table 4.
Total Vriance Explained for MEPS

Items	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	5,152	32,197	32,197	5,152	32,197	32,197	4,676	29,227	29,227
2	4,320	27,001	59,198	4,320	27,001	59,198	4,250	26,562	55,789
3	2,978	18,612	77,810	2,978	18,612	77,810	3,523	22,021	77,817
4	,552	3,451	81,260						

Table 4 shows that for the scale with three dimensions and eigenvalues higher than one, the varimax rotation of the main components analysis generates a total explained variance of 77.81%.

Table 5.
EFA Results and Factor Loadings of MEPS Items

Dimensions	Items	1	2	3
Metacognitive Competence	m10	.774		
	m11	.789		
	m12	.820		
	m13	.822		
	m14	.791		
	m15	.852		
	m16	.845		
Metacognitive Knowledge	m1		.921	
	m2		.940	
	m3		.893	
	m4		.907	
	m5		.927	
Metacognitive Support	m6			.895
	m7			.953
	m8			.941
	m9			.922
Total Variance			77.817	

When Table 5 is examined, no item was discarded because no overlapping feature was observed in any item in the EFA results obtained as a result of the varimax rotation performed on the principal component analysis. As a result of EFA, the MEPS consists of a total of 16 items and three dimensions. The total explained variance ratio was calculated as 77.817%.

In order to ensure that the structure resulting from EFA is verified with the collected data, CFA is recommended (Seçer, 2015). The results of the CFA conducted in this direction are given below.

Table 6.

Confirmatory Factor Loadings of MEPS Items

				95% Confidence Intervals				
Latent	Observed	Estimate	SE	Lower	Upper	β	z	p
Endogenous1	m1	1.000	0.0000	1.000	1.000	0.961		
(Metacognitive Knowledge)	m2	1.037	0.0150	1.007	1.066	0.997	69.31	<.001
	m3	0.984	0.0176	0.950	1.019	0.946	56.08	<.001
	m4	0.988	0.0168	0.955	1.021	0.950	58.67	<.001
	m5	1.004	0.0121	0.981	1.028	0.966	83.12	<.001
Endogenous2	m6	1.000	0.0000	1.000	1.000	0.890		
(Metacognitive Support)	m7	1.091	0.0298	1.033	1.149	0.971	36.64	<.001
	m8	1.081	0.0284	1.025	1.137	0.962	38.11	<.001
	m9	1.055	0.0279	1.000	1.109	0.938	37.86	<.001
Endogenous3	m10	1.000	0.0000	1.000	1.000	0.864		
(Metacognitive Competence)	m11	0.919	0.0892	0.745	1.094	0.794	10.31	<.001
	m12	0.840	0.0826	0.678	1.002	0.726	10.17	<.001
	m13	0.995	0.1002	0.798	1.191	0.860	9.93	<.001
	m14	0.850	0.1058	0.642	1.057	0.734	8.03	<.001
	m15	0.816	0.0855	0.649	0.984	0.705	9.54	<.001
	m16	0.748	0.0714	0.608	0.888	0.647	10.48	<.001

This table shows the standardized factor coefficients obtained from the confirmatory factor analysis (CFA). All coefficients are statistically significant ($p < .001$).

The standardized factor coefficients obtained from the confirmatory factor analysis (CFA) revealed that the items were highly correlated with their respective factors. The factor coefficients for all items in the Endogenous1 (Metacognitive Knowledge) and Endogenous2 (Metacognitive Support) subdimensions ranged from 0.946 to 0.997 and from 0.890 to 0.971, respectively, indicating strong representation of both factors. The factor coefficients for the items in the Endogenous3 (Metacognitive Competence) subdimension ranged from 0.647 to 0.864. Although some coefficients in this factor were below .70, the fact that all coefficients were above .50 suggests that this subdimension also demonstrates an acceptable level of construct validity (Hair, Black, Babin, & Anderson, 2019). All coefficients are statistically significant ($p < .001$), and no cross-loadings were observed.

Reliability Indices for Subdimensions

Note. This table presents the reliability indices calculated for each subdimension as part of the confirmatory factor analysis. Cronbach's alpha, ordinal alpha, and McDonald's omega (ω_1, ω_2, ω_3) coefficients were evaluated in terms of internal consistency reliability. The AVE value represents convergent validity for each subdimension.

Table 7.
Internal Consistency and AVE Values of MEPS Subdimensions

Subdimension (Factor)	Cronbach's Alpha(α)	Ordinal Alpha	ω_1	ω_2	ω_3	AVE
Metacognitive Knowledge	0.962	0.986	0.952	0.952	0.953	0.930
Metacognitive Competence	0.816	0.903	0.831	0.831	0.844	0.585
Metacognitive Support	0.938	0.967	0.927	0.927	0.932	0.885

The internal consistency of the scale developed within the scope of the study was evaluated using Cronbach's alpha coefficients. The scale consists of three subdimensions: Metacognitive Knowledge, Metacognitive Support, and Metacognitive Competence. Cronbach's alpha coefficients were calculated separately for each subdimension, as well as for the entire scale. The Cronbach's alpha coefficient for the five items in the Endogenous1 (Knowledge) subdimension was found to be .96, and for the four items in the Metacognitive Support subdimension, it was .94. These values indicate a very high level of internal consistency for the respective subdimensions. For the seven items in the Endogenous3 (Competence) subdimension, the Cronbach's alpha coefficient was calculated as .82, which reflects an acceptable level of internal consistency. The overall Cronbach's alpha coefficient for the entire scale was determined to be .75, indicating that the scale as a whole has an acceptable to good level of internal consistency (George & Mallery, 2003).

The construct validity of each subdimension was evaluated using AVE (Average Variance Extracted) values. The AVE value for the Metacognitive Knowledge subdimension was found to be .930, for the Metacognitive Support subdimension .885, and for the Metacognitive Competence subdimension .596. These values indicate that all subdimensions exceed the threshold of .50 recommended by Fornell and Larcker (1981), thereby supporting the construct validity of each subdimension.

Table 8.
Correlation Matrix Among the Subdimensions of MEPS

	Metacognitive Knowledge	Metacognitive Competence	Metacognitive Support
Metacognitive Knowledge	0.925	0.231	-0.090
Metacognitive Competence	0.169	0.814	-0.412
Metacognitive Support	-0.082	-0.379	0.786

The variance values for the three subdimensions were found to be high (Knowledge = .925, Competence = .814, Support = .786). A positive and weak correlation was observed between Knowledge and Competence ($r = .169$), while negative correlations were found between Competence and Support ($r = −.379$), and between Knowledge and Support ($r = −.082$). These results indicate that the Support subdimension is theoretically distinct from the other two subdimensions and contributes in the opposite direction. The internal consistency of the factors, along with their interrelationships, supports the theoretical and statistical significance of the scale's three-dimensional structure (Büyüköztürk, 2012; Hair et al., 2019; Tabachnick & Fidell, 2007). The negative associations between the Support subdimension and the other subdimensions, in particular, provide consistent evidence that this factor represents a "need for support."

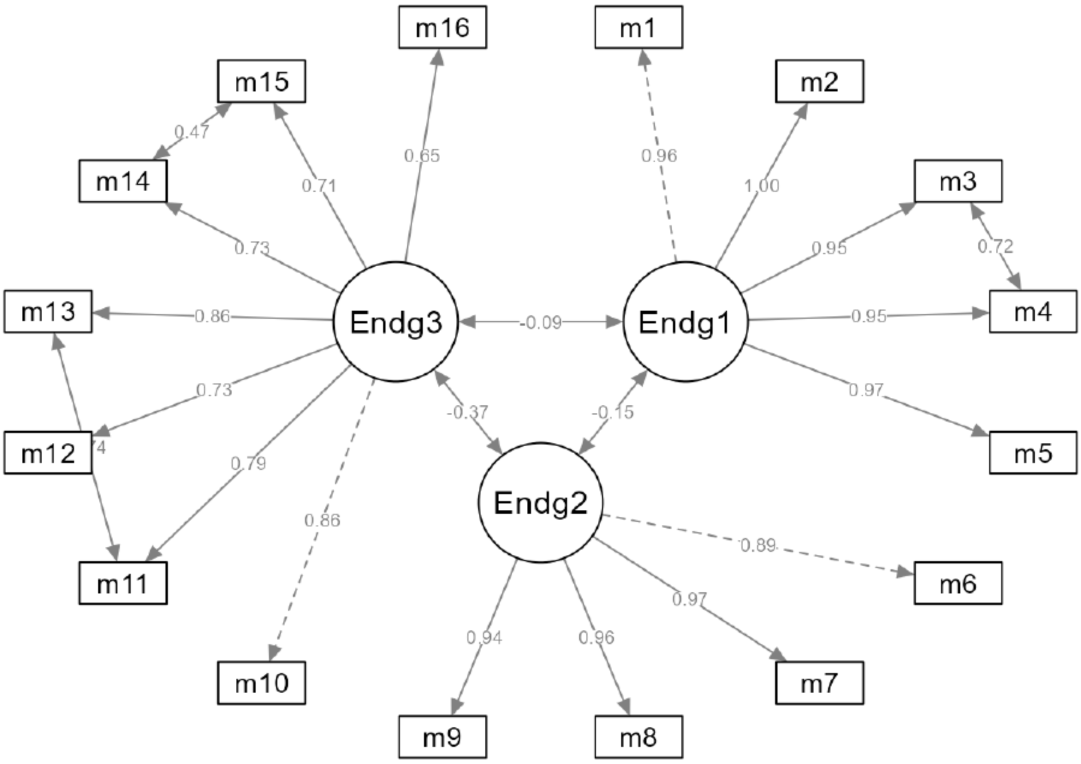

Figure 2. CFA Model for MEPS

Figure 2 shows how a total of 16 observed variables and three latent variables are explained. It was discovered that the item factor loadings were significant in statistical terms.

Table 9.
Comparison for MEPS's CFA results and CFA Fit Indices

Fit Indices	Acceptable Range	Perfect Range	Fit Indices of MEPS
NFI	.90	.95 and above	.910
IFI	.90	.95 and above	.973
CFI	.90	.97 and above	.972
GFI	.85	.90 and above	.944
AGFI	.85	.90 and above	912
TLI	.90	.95 and above	.963
SRMR	.08	.05	.057
RMR	Between .05 and .8	Between .00 and .05	.051
RMSEA	Between .05 and .8	Between .00 and .05	.053
CMIN/DF	1.641		
Chi Square	246.293		
DF	150		

In Table 9, the statistical values regarding the model fit based on the results of the confirmatory factor analysis (CFA) are as follows: $\chi^2(150) = 246.293$, $p < .001$; $\chi^2/df = 1.641$, which is considered an excellent fit indicator as it is below 2 (Kline, 2016). Additionally, the incremental fit indices CFI = .972, TLI = .963, and IFI = .973 being above the .95 threshold indicate a perfect model fit (Hu & Bentler, 1999). The values of GFI = .944 and AGFI = .912 also show that the model demonstrates a very good fit (Hair, Black, Babin, & Anderson, 2019). The error indices, RMSEA = .053 and SRMR = .057, fall within acceptable limits (Byrne, 2016; Hu & Bentler, 1999). In conclusion, the findings from the confirmatory factor analysis support that the model fits the data well.

Table 10.
Scores and Names of Sub-dimensions of the Scale

Sub-dimensions	Items	Lowest Score	Highest Score
Metacognitive Knowledge	m1-m2-m3-m4-m5	5	15
*Metacognitive Support	m6-m7-m8-m9	4	12
Metacognitive Competence	m10-m11-m12-m13-m14-m15-m16	7	21

* Reverse-coded

In Table 10, the scale consists of three subdimensions: Metacognitive Knowledge (items m1–m5), Metacognitive Competence (items m10–m16), and Metacognitive Support Need (items m6–m9). The Support subdimension reflects teachers' need for external support in metacognitive processes. Therefore, the items in this subdimension were reverse-coded during analysis. This approach ensures that higher scores across the entire scale consistently represent higher levels of metacognitive competence.

Table 11. Independent Samples t-Test Results for Preschool Teachers' Educational Level on the Metacognitive Proficiency Scale

Educational Level	N	M	SD	SE	t	df	p	Mean Diff.	95% CI (LL)	95% CI (UL)
Bachelor's Degree	215	2.34	0.31	0.021	-0.393	277.0	0.694	-0.0168	-0.1008	0.0672
Graduate Degree	64	2.35	0.26	0.032	-0.437	123.83	0.663	-0.0168	-0.0928	0.0592

Equal variances assumed (Levene's test: F = 2.064, p = .152). M = Mean, SD = Standard Deviation, SE = Standard Error, CI = Confidence Interval.

To further evaluate the construct validity of the *Metacognitive Proficiency Scale for Preschool Teachers*, a known-groups comparison was conducted based on participants' educational backgrounds. An independent samples t-test revealed no statistically significant difference between the two groups, $t(277) = -0.393$, $p = .694$. The mean scores were highly comparable, and the 95% confidence interval for the mean difference included zero, indicating no practically meaningful difference in metacognitive proficiency based on formal education level.

Discussion, Conclusion, and Suggestions

In multi-factor scale development studies, the total explained variance ratio should exceed 50% (Güriş & Astar, 2015). The Metacognition Proficiency Scale for Preschool Teachers (MEPS) achieved a total explained variance ratio of 77.817%. For an item to be considered a factor, its factor loading must be .40 or higher (Field, 2018). The results of the Exploratory Factor Analysis (EFA) showed that the factor loadings of the items in the MEPS ranged from .613 to .922, resulting in no items being discarded. Consequently, the EFA revealed that the MEPS consists of 16 items organized into three sub-dimensions. These sub-dimensions were named "metacognitive competence," "metacognitive knowledge," and "metacognitive support," based on the common features of the items loading onto each sub-dimension (Altunışık et al., 2007; Erkuş, 2012; Seçer, 2015). CFA was conducted to verify this structure, and all items were found to be significant (Jöreskog & Sörbom, 1996). The fit indices for the model were: X2/sd = 1.805, TLI = .94, RMSEA = .78, indicating acceptable fit, and RMR = .23, indicating good fit (Kelloway, 1998; Schermelleh-Engel et al., 2003). The total Cronbach's alpha for the MEPS was calculated to be .75, which is considered good (George & Mallery, 2003).

When compared to the Metacognitive Awareness Inventory (MAI), developed by Schraw and Dennison (1994), and the metacognition scales included in Zohar's (2006) studies, The MEPS particularly contains both similar structures and unique dimensions. The "knowledge about information" and "organization" dimensions in the MAI overlap with the "metacognitive knowledge" and "metacognitive competence" sub-dimensions in the MEPS. Furthermore, the third dimension of the MEPS, "metacognitive support," stands out as a construct specific to preschool teachers' roles in supporting metacognition in their classroom practices. This dimension reflects not only the teacher's own thinking processes but also their capacity to guide and support children's thinking processes, contributing to an area that has received limited attention in the literature. The study findings can be interpreted within the framework of Flavell's (1979) theory of metacognition and Schraw and Moshman's (1995) two-dimensional model of metacognition (knowledge and regulation). The emergence of the "metacognitive support" dimension as an independent factor highlights the importance of considering social and pedagogical support processes alongside cognitive awareness, particularly in the context of teacher cognition. This offers a new perspective on how preschool teachers structure metacognitive strategies in pedagogical interactions and demonstrates that metacognition is functional not only in individual but also in social contexts.

The criterion validity of the MEPS was not tested in this study. This deficiency could be addressed in future research through classroom observations, correlation studies with student achievement, or comparative analyses with teacher performance data. In particular, the relationship between the "metacognitive support" dimension and instructional outcomes should be examined in depth within the context of teacher-child interactions. The MEPS has the potential to be used to assess teachers' metacognitive competencies in teacher training programs and in-service training. The scale can be used among tools for developing teachers' self-reflection skills. It can also be used by school administrators to monitor professional development processes and provide data for teacher evaluation systems. For policymakers, considering the impact of teacher cognition on child development in early childhood education, it is recommended that content that strengthens metacognitive competencies be integrated into teacher education policies.

The emergence of the "Metacognitive Support" dimension as a separate factor in the scale highlights the significance of teachers’ need for external resources or guidance to effectively manage their metacognitive processes. Flavell (1979) emphasized the role of external factors in the development of metacognition, underscoring the importance of external guidance that aids individuals in better understanding their cognitive processes. Another reason for this factor appearing as a distinct dimension is the reality that even when teachers are aware of their own metacognitive processes, they may still require additional support to effectively convey these processes to their students in the classroom. Schraw, Crippen, and Hartley (2006) stressed that teachers need support in teaching metacognition and that they learn to apply metacognitive strategies more effectively through professional development programs.

From the perspective of teachers’ cognition, the identification of metacognitive support as a separate factor indicates that managing one’s own cognitive processes is not sufficient; teachers also have the responsibility to foster and support students’ metacognitive awareness. Accordingly, receiving metacognitive support enables teachers to conduct cognitive and metacognitive processes in the classroom more consciously, systematically, and effectively (Perry, Lundie, & Golder, 2019). Various studies have demonstrated that teachers’ access to metacognitive support positively contributes to teaching quality, facilitates students’ development of cognitive and metacognitive skills, and enriches the overall learning environment (Wilson & Bai, 2010). Therefore, it is clear that metacognitive support—necessary for teachers to manage cognitive processes at a higher level—should be regarded as a fundamental element supporting teachers' professional development. The emergence of the "Metacognitive Support" dimension as a separate factor in your scale aligns theoretically with the models proposed by Flavell and Schraw & Moshman, indicating that teachers require external support while developing their metacognitive processes. This underscores the necessity of providing metacognitive support mechanisms to enable teachers to manage their metacognitive processes effectively.

In conclusion, the MEPS comprises 16 items across three sub-dimensions, using a 3-point Likert scale. The total explained variance rate is 77.817%, and the Cronbach's alpha value is .75, indicating that the MEPS is a reliable and valid measurement tool. Future research could involve conducting a norm study with a larger sample size to further validate the scale.

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Ethics statement: In this study, we declare that the rules stated in the "Higher Education Institutions Scientific Research and Publication Ethics Directive" are complied with and that we do not take any of the actions based on "Actions Against Scientific Research and Publication Ethics". At the same time, we declare that there is no conflict of interest between the authors, which all authors contribute to the study, and that all the responsibility belongs to the article authors in case of all ethical violations.

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Conflict of Interest: The author declares no conflict of interest regarding the publication of this study.

Generative Artificial Intelligence Statement: The authors used ChatGPT for language editing.

Author Note : The Metacognition Proficiency Scale Designed For Preschool Educators (MEPS) (In Appendix 1, the full version of the scale is provided.) developed as part of this study may be freely used for research purposes, provided that appropriate citation is given. No additional permission is required for its use in academic research. However, for any adaptations, translations, or commercial use of the scale, it is recommended to contact the authors.

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Appendix 1

Metacognition Proficiency Scale Designed For Preschool Educators (MEPS)

1. Structure of the Scale:

Metacognition Proficiency Scale Designed For Preschool Educators (MEPS) is developed to assess teachers' perceptions regarding their **metacognitive knowledge**, **competence**, and **need for support**. The scale consists of **three sub-dimensions**:

- **Metacognitive Knowledge (Knowledge):** Includes items **m1–m5**. Evaluates the teacher's **theoretical and practical understanding** of the concept of metacognition.
- **Metacognitive Competence (Competence):** Includes items **m10–m16**. Measures the teacher's **ability to apply metacognitive strategies** in their own teaching practices.
- **Metacognitive Support (Support):** Includes items **m6–m9**. Reflects the teacher's **need for external support** in metacognitive processes. **Note: This sub-dimension is reverse-scored.**

2. Scoring Guide:

All items are rated on a **3-point Likert scale**:

- 1 = Disagree
- 2 = Neutral
- 3 = Agree

Reverse Coding:

Items in the **Support** sub-dimension (**m6, m7, m8, m9**) must be **reverse-coded** to ensure that **a higher score reflects higher metacognitive competence**. Reverse coding transformation:

- 1 → 3
- 2 → 2
- 3 → 1

Subscale Score Calculation:

- **Knowledge =** (m1 + m2 + m3 + m4 + m5) / 5
- **Competence =** (m10 + m11 + m12 + m13 + m14 + m15 + m16) / 7
- **Support =** (reverse-coded m6 + m7 + m8 + m9) / 4

Optionally, an **overall total score** can be calculated by averaging the three sub-dimensions. However, due to the conceptual distinctions among sub-dimensions, **it is recommended to report them separately**.

3. Interpretation:

- **High scores** indicate that the teacher has:
  - A **high level of metacognitive knowledge**
  - A **strong competence** in applying metacognitive strategies
  - A **low need for external support** in metacognitive processes

It is essential to interpret each sub-dimension by considering its **unique structural characteristics**.

Metacognition Proficiency Scale Designed For Preschool Educators (MEPS)

	Disagree	Moderately Agree	Agree
1. I have knowledge about children's metacognitive skills. (Çocukların üst bilişsel becerileri hakkında bilgim var.)			
2. I can design activities to enhance children's metacognitive skills. (Çocukların üst biliş becerilerini geliştirecek etkinlikler hazırlayabilirim.)			
3. I know the methods and techniques that support the development of children's metacognitive skills. (Çocukların üst biliş becerilerini geliştirecek yöntem ve teknikleri biliyorum.)			
4. I can organize learning environments that promote children's metacognitive development. (Çocukların üst biliş becerilerini geliştirecek eğitim ortamları düzenleyebilirim.)			
5. I can ask questions that help children improve their metacognitive skills. (Çocukların üst biliş becerilerini geliştirecek sorular sorabilirim.)			
6. I think I need support regarding what children's metacognitive skills are. (Çocukların üst biliş becerilerinin neler olduğu hakkında destek almam gerektiğini düşünüyorum.)			
7. I think I need support regarding methods and techniques to develop children's metacognitive skills. (Çocukların üst biliş becerilerini geliştirecek yöntem ve teknikler hakkında destek almam gerektiğini düşünüyorum.)			
8. I think I need support to organize educational environments that foster metacognitive skills. (Çocukların üst biliş becerilerini geliştirecek eğitim ortamları düzenlemeye yönelik destek almam gerektiğini düşünüyorum.)			
9. I think I need support to be able to prepare activities that develop children's metacognitive skills. (Çocukların üst biliş becerilerini geliştirecek etkinlikler hazırlayabilmek için destek almam gerektiğini düşünüyorum.)			
10. I provide opportunities for children to evaluate themselves. (Çocuğun kendini değerlendirmesine fırsat sunarım.)			
11. I give children the opportunity to explain how they completed the activity. (Çocuklara etkinliklerini tamamladıktan sonra nasıl yaptığını anlatmasına fırsat tanırım.)			
12. I ask children for their opinions on what they learned during the process of completing the activity. (Çocuklara etkinliği tamamlama sürecinde neler öğrendiklerine dair görüşlerini sorarım.)			
13. I provide opportunities for children to reflect on themselves. (Çocukların kendilerini sorgulamasına fırsat tanırım.)			
14. I help children make connections between what they have newly learned and their prior knowledge. (Çocukların yeni öğrendikleri ile önceki bilgileri arasında ilişki kurmalarını sağlarım.)			
15. I ask what children need in order to solve a problem successfully. (Bir problemi başarıyla çözebilmek için neye ihtiyaçları olduğunu sorarım.)			
16. I provide opportunities for children to develop their own strategies for learning a concept. (Bir kavramı kazandırmak için çocukların kendilerine ait stratejiler geliştirmelerine olanak sağlarım.)			