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RESEARCH ARTICLE / ARAŞTIRMA YAZISI

The Mediating Role of Metacognition in the Relationship between the Theory of Mind and Working Memory

Zihin Kuramı ile Çalışma Belleği Arasındaki İlişkide Üstbilişin Aracı Rolü

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Abstract:

This study examined the mediating role of metacognition in the relationship between ToM and working memory. The independent variable of this study was working memory, the dependent variable was ToM, and the mediating variable was metacognition. This study was conducted using a general survey model with 300 children in the age group of five years who attended an independent kindergarten affiliated with the Ministry of National Education in Konya city center. General Information Form, Metacognitive Knowledge Interview Form (McKI), Theory of Mind Task Battery (TOMTB), and Working Memory Scale were used as data collection tools. In the data analysis, the relationships between the measurements were examined. It was seen that there was a statistically significant positive relationship between the scores of the Metacognitive Knowledge Interview Form (McKI) and the Theory of Mind Task Battery (TOMTB); between the Working Memory Scale and the Theory of Mind Task Battery (TOMTB); and between the Working Memory Scale and the Metacognitive Knowledge Interview Form (McKI) ($p<0.05$). When the mediation model was established, it was seen that the theory of mind had no statistically significant effect on working memory; metacognition had a significant positive impact on working memory, and theory of mind and metacognition significantly explained the change in working memory scores. These results support the main hypothesis that the theory of mind significantly affects working memory through metacognition.

Keywords: Metacognition, Working Memory, Theory of Mind, Cognitive Development, Mediation Analysis.

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Öz:

Bu çalışmada zihin kuramı ile çalışma belleği arasındaki ilişkide üstbilişin aracı rolü incelenmiştir. Çalışmanın bağımsız değişkeni çalışma belleği, bağımlı değişkeni zihin kuramı ve aracı değişkeni üstbiliştir. Çalışma, Konya il merkezinde Milli Eğitim Bakanlığı'na bağlı bağımsız bir anaokuluna devam eden 5 yaş grubundaki 300 çocukla genel tarama modeli kullanılarak yürütülmüştür. Veri toplama aracı olarak Genel Bilgi Formu, Üstbilişsel Bilgi Görüşme Formu (McKI), Zihin Kuramı Görev Bataryası (TOMTB) ve Çalışma Belleği Ölçeği kullanılmıştır. Verilerin analizinde ölçümler arasındaki ilişkiler incelenmiştir. Üstbilişsel Bilgi Görüşme Formu (McKI) ile Zihin Kuramı Görev Bataryası (TOMTB) puanları arasında, Çalışma Belleği Ölçeği ile Zihin Kuramı Görev Bataryası (TOMTB) puanları arasında ve Çalışma Belleği Ölçeği ile Üstbilişsel Bilgi Görüşme Formu (McKI) puanları arasında istatistiksel olarak anlamlı pozitif bir ilişki olduğu saptanmıştır ($p<0.05$). Aracılık modeli kurulduğunda, zihin kuramının çalışma belleği üzerinde istatistiksel olarak anlamlı bir etkisinin olmadığı, üstbilişin çalışma belleği üzerinde anlamlı bir pozitif etkiye sahip olduğu ve zihin kuramı ve üstbilişin çalışma belleği puanlarındaki değişimi anlamlı bir şekilde açıkladığı görülmüştür. Bu sonuçlar, zihin kuramının üstbiliş yoluyla çalışma belleği üzerinde anlamlı bir etkiye sahip olduğu ana hipotezini desteklemektedir.

Anahtar Kelimeler: Üstbiliş, Çalışma belleği, Zihin kuramı, Bilişsel gelişim, Aracılık analizi.

Introduction

Theory of mind (ToM) is the cognitive representation of other individuals' mental states. Through ToM, inferences can be made about other individuals' thoughts, understandings, interpretations, and feelings about the individual's behavior. In addition, ToM also plays a role in predicting the behavior of other individuals (Rivero-Contreras, Saldana & Micai, 2023).

To better understand the developmental aspect of the ToM, it is crucial to examine the developmental processes of how this skill is shaped from childhood onwards. ToM is a skill that can be acquired rapidly and over a long developmental period in typical development, progressing in a similar developmental sequence worldwide, requiring the learning and development of a set of specific abilities to interact with and represent others (Wellman, 2014).

While the development of ToM affects an individual's social relationships, the relationship of this skill with interpersonal interactions and other cognitive areas is also noteworthy. ToM helps individuals to organize their social interactions and relationships. A study found that children between the ages of 4-6 years were increasingly better able to establish the connection between physical symptoms and anxiety. This reveals that children's cognitive development is related to ToM (Muris, Mayer, Vermeulen, & Hiemstra, 2007). In other studies, the relationship between ToM and language skills (Lockl & Schneider, 2007), social interaction (McElwain et al., 2019), cognitive empathy (Bensalah, Caillies & Anduze, 2016), and metacognition (Jahromi & Stifter, 2008; Mohamed, 2012) is noteworthy. As evidenced by research, the theory of mind is key component of social cognitive development of individuals and shows its effects in many areas. In this context, studies conducted with typically developing individuals are important for understanding the factors that are effective in the development of ToM.

Another significant cognitive area that has been shown to be related to the theory of mind is working memory. Working memory refers to the small amount of information that can be retained and is responsible for performing cognitive tasks. Working memory is associated with intelligence, comprehension, learning, problem-solving, executive function, and information-processing skills from infancy to old age. Working memory supports planning, comprehension, reasoning, and problem-solving processes and plays a critical role in concept formation and learning (Cowan, 2014). Working memory provides the ability to keep previous information in mind and associate it with later information. Therefore, working memory is of great importance for the process of interpretation (Diamond, 2013). Studies show that higher working memory is linked to greater learning capacity (Pack, Choi, & Kim, 2023) and is associated with reasoning (Simms, Frausel, & Richland, 2018),cognitive development (Jena et al., 2019), and executive function (Vugs et al., 2014). Working memory plays an important role in children's learning processes and cognitive development. In this context, research on working memory provides an important basis for understanding children's cognitive development.

While working memory plays a central role in learning and cognitive functioning, metacognitive skills that include the individual's awareness and regulation capacity regarding their own mental processes are also increasingly gaining attention. Metacognition is an individual's idea of their thoughts or perspectives on their cognitive processes (Ochilova, 2021). By age four, children understand that others' beliefs and desires may differ from their own and can be mistaken, developing awareness of the source of knowledge (Kuhn, 2000). Metacognition, reflecting on one's thoughts, supports learning and is linked to motivation, goal-setting, self-regulation, and self-efficacy (Sato, 2022). Research indicates that metacognitive education is associated with children's problem-solving (Kontos & Nicholas, 1986), role-playing games (Whitebread & O'Sullivan, 2012), peer learning (Whitebread et al., 2007), and self-regulated learning skills (Dörr & Perels, 2019). In this context, it is important to develop methods to support children's metacognitive skills.

Children's theory of mind (ToM) is closely linked to executive functions (Apperly, Samson, & Humphreys, 2009), with some arguing ToM underlies executive functions and others the reverse, though evidence remains inconclusive (Perner & Lang, 1999). Working memory, a core executive function (Diamond, 2013), enables limited-capacity information processing, and its effectiveness is enhanced through metacognition and strategy use (McNamara & Scott, 2001). In this study, the structuring

of the model from the theory of mind to working memory is consistent with developmental theories that social cognitive development, especially in early childhood, forms the basis for the development of metacognitive skills that allow individuals to regulate their mental processes (Perner & Lang, 1999). In other words, children first acquire the ability to understand the mental states of others, that is, theory of mind; they apply this ability to their cognitive processes and develop metacognitive control skills; these skills ultimately support more effective use of working memory. Therefore, this model was planned to test the view that the theory of mind affects metacognition and that metacognition shapes working memory performance.

Theory of mind, working memory and metacognitive skills are closely related and play a determining role in children's cognitive and social development processes. The relationship between working memory and ToM plays an important role in individuals' social interactions and cognitive functioning. The mediating role of metacognition in this relationship may help individuals better understand their cognitive processes and manage social situations more effectively. In this context, examining the interactions between ToM and working memory forms the basis of this study.

Hypothesis of this Study

This study aims to test the hypothesis that "metacognition has a mediating role in the relationship between ToM and working memory." The following hypotheses will be tested in line with the main hypothesis:

Theory of mind has a significant effect on metacognition.

Metacognition has a significant effect on working memory.

Theory of mind has a significant effect on working memory.

The theoretical model of this study is shown in Figure 1..

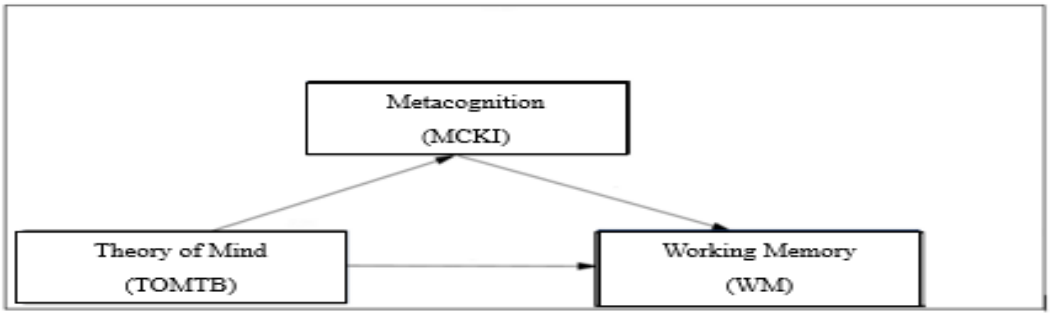

Figure 1. *Theoretical Model of this Study*

Method

This study was conducted with the general survey model and was conducted by scientific ethical principles. The independent variable of this study was working memory, the dependent variable was theory of mind, and the mediating variable was metacognition.

Working Group

This study was conducted on 300 5-year-old children in Konya. Certain inclusion and exclusion criteria were used to determine the children who would participate in this study. Inclusion criteria were determined as being in the relevant age group, being able to participate regularly in the research implementation process and having written consent from their parents. The exclusion criteria were children with special needs (such as developmental delay, diagnosed neurological or physical disability) and children who did not attend the research process or whose parental consent could not be obtained. Accordingly, the study sample was limited to 300 children who met the specified criteria. Based on previous studies, it was concluded that a sample size of 300 provided sufficient statistical power to identify direct and indirect effects (Fritz & MacKinnon, 2007; MacKinnon et al., 2012). Furthermore, a simulation-based power analysis method was applied in the regression-based mediation analysis (Qin, 2024). The sample size was large enough to detect both direct and indirect effects. In the study, the mediating effect of metacognition on the effect of theory of mind on working memory was examined, and an appropriate mediating effect model was created. The R2 value was 0.109 in the model. For 300 participants, the power of the study was calculated as 0.999 as a result of post-hoc power analysis at a 5% significance level.

F tests - Linear multiple regression: Fixed model, R^2 deviation from zero

Analysis: Post hoc: Compute achieved power
Input: Effect size f^2=0.109
α err prob=0.05
Total sample size =300
Number of predictors=2
Output: Noncentrality parameter λ=32.7000000
Critical F =3.0261534
Numerator df=2
Denominator df=297
Power (1-β err prob)=0.9996290

Therefore, the research sample was to be 300 participants. Data on the demographic characteristics of the participants are presented in Table 1.

Table 1. *Descriptive statistics of participants' demographic characteristics (N=300).*

Information	**Specifications**	***n***	***%***
Gender	Female	142	47.3
	Male	158	52.7
Age category	60-65 months	161	53.7
	66-71 months	139	46.3
Birth order	First child	140	46.7
	Middle child or one of the middle children	39	13.0
	Last Child	121	40.3
Number of children in the family	1 child	89	29.7
	2 children	151	50.3
	3 children and more	60	20.0
Economic situation	Medium	209	69.7
	High	91	30.3
Mother's age	29 years and below	22	7.3
	30-39 years	240	80.0
	40-49 years	38	12.7
Father's age	29 years and below	11	3.7
	30-39 years	219	73.0
	40-49 years	70	23.3
Mother's Education	High school and below	109	36.3
	University and above	191	63.7
Father's Education	High school and below	90	30.0
	University and above	210	70.0
Mother's employment status	Working	191	63.7
	Not working	109	36.3
Father's employment status	Working	296	98.7
	Not working	4	1.3

Descriptive statistics are given as number (n) and percentage (%) values.

Information on the comparison of the mean scale scores according to the participants' descriptive characteristics is given in Table 2.

Table 2. *Comparison of mean scale scores according to participants' descriptive characteristics(N=300).*

Information	Feature	Theory of Mind Task Battery	Test (*p*)	Metacognitive Knowledge Interview Form	Test (*p*)	Working Memory Scale	Test (*p*)
		X* ± *SS		***X* ± *SS***		***X* ± *SS***	
Gender	Female	12.16 ± 1.84	t=0.596 *p*=0.552	19.04 ± 3.53	**t=2.335 *p*=0.020**	40.51 ± 9.08	t=1.643 *p*=0.101
	Male	12.03 ± 2.10		18.03 ± 3.96		38.75 ± 9.36	

Age category	60-65 months	12.28 ± 1.95	t=1.790 *p*=0.074	18.78 ± 3.95	t=1.327 *p*=0.185	39.09 ± 9.06	t=-1.000 *p*=0.318
	66-71 months	11.87 ± 2.00		18.19 ± 3.59		40.16 ± 9.48	
Birth order	First child	12.15 ± 2.00	F=2.337 *p*=0.098	18.59 ± 4.12	F=2.045 *p*=0.131	40.29 ± 9.84	F=0.771 *p*=0.463
	Middle child or one of the middle children	12.62 ± 2.07		19.49 ± 3.48		39.21 ± 7.99	
	Last Child	11,85 ± 1,90		18,10 ± 3,45		38,89 ± 8,95	
Number of children in the family	1 child	12,18 ± 1,80	F=0,418 *p*=0,659	18,75 ± 3,61	F=0,724 *p*=0,485	40,48 ± 10,26	F=0,900 *p*=0,407
	2 children	11,99 ± 1,99		18,25 ± 3,90		39,52 ± 8,76	
	3 children and more	12,22 ± 2,21		18,80 ± 3,81		38,42 ± 8,90	
Economic situation	Medium	11,96 ± 1,91	t=-1,770 *p*=0,078	18,11 ± 3,75	**t=-2,775 *p*=0,006**	39,22 ± 9,61	t=-1,017 *p*=0,310
	High	12,40 ± 2,11		19,42 ± 3,76		40,41 ± 8,39	
Mother's age	29 years and below	11,32 ± 2,40	F=2,083 *p*=0,126	17,59 ± 5,63	F=0,870 *p*=0,420	38,77 ± 11,23	F=0,397 *p*=0,672
	30-39 years	12,12 ± 1,92		18,63 ± 3,45		39,82 ± 9,05	
	40-49 years	12,37 ± 2,03		18,24 ± 4,55		38,55 ± 9,48	
Father's age	29 years and below	12.91 ± 2.12	F=1.444 p=0.238	19.55 ± 4.82	F=1.413 p=0.245	40.64 ± 9.41	F=0.122 p=0.885
	30-39 years	12.00 ± 1.96		18.64 ± 3.70		39.64 ± 9.44	
	40-49 years	12.26 ± 2.01		17.91 ± 3.90		39.24 ± 8.76	
Mother's Education	High school and below	11.73 ± 2.03	**t=-2.371 *p*=0.018**	17.59 ± 4.17	**t=-3.221 *p*=0.001**	38.93 ± 10.47	t=-0.928 *p*=0.354
	University and above	12.29 ± 1.93		19.03 ± 3.47		39.96 ± 8.49	
Father's Education	High school and below	11.72 ± 2.04	**t=-2.118 *p*=0.035**	17.29 ± 4.29	**t=-3.717 *p*<0.001**	38.98 ± 10.93	t=-0.741 *p*=0.459
	University and above	12.25 ± 1.94		19.03 ± 3.44		39.84 ± 8.45	
Mother's employment status	Working	12.28 ± 1.89	**t=2.246 *p*=0.025**	19.08 ± 3.32	**t=3.555 *p*<0.001**	40.48 ± 8.64	**t=2.227 *p*=0.027**
	Not working	11.75 ± 2.09		17.50 ± 4.33		38.02 ± 10.10	
Father's employment status	Working	12.10 ± 1.98	t=0.599 *p*=0.549	18.52 ± 3.79	t=0.666 *p*=0.506	39.61 ± 9.28	t=0.453 *p*=0.651
	Not working	11.50 ± 2.52		17.25 ± 4.35		37.50 ± 8.50	

Independent Sample t-test (t); ANOVA (F); Descriptive statistics are given as mean (X). standard deviation (SD) values. The sections marked in bold are statistically significant ($p<0.05$).

Analyses revealed that theory of mind, metacognition and working memory skills showed significant differences according to the gender, income level and some characteristics of the participants' parents. Detailed information on this is presented in Table 2.

Data Collection Tools

General Information Form: "General Information Form" refers to a multiple-choice form prepared to determine the demographic characteristics of children and families, such as age, education level and gender.

Metacognitive Knowledge Interview Form (McKI): It was developed by Marulis et al. (2016) to examine metacognitive knowledge, and its Turkish adaptation was conducted by Keleş Ertürk and Tepeli (2023a). There are 15 questions in the interview form. The answers given by the child are evaluated based on 0, 1 and 2 points. Between 0 and 15 points, it is evaluated as partially metacognitive; 15 points and above, it is evaluated as completely metacognitive. It was determined that the Cronbach's Alpha coefficient of the adapted McKI was 0.81, the inter-observer reliability was 0.99, the test-retest reliability was 0.72, the standard deviation value was 5.54, the skewness value was 0.138, the kurtosis value was -0.57, and the factor loadings were between 0.37 and 0.73 (Keleş Ertürk & Tepeli, 2023a).

Theory of Mind Task Battery (TOMTB): The TOMTB was developed by Hutchins, Prelock, and Chace in 2008 for children aged 3.5-5.5 years (Hutchins & Prelock, 2010). The Turkish adaptation of the battery was conducted by Keleş Ertürk and Tepeli (2023b). The TOMTB Battery was developed for children aged 3.5-5.5 (Hutchins & Prelock, 2010). The Turkish adaptation of the battery was made by Keleş Ertürk and Tepeli (2023b). The KR-20 reliability coefficient of the adapted TOMTB is 0.59 for the Basic Subscale and 0.72 for the Advanced Subscale; the test-retest reliability coefficients are 0.75 for the Basic Subscale and 0.76 for the Advanced Subscale. The factor loadings range from 0.04 to 0.66 for the Basic Subscale and from 0.17 to 0.99 for the Advanced Subscale (Keleş Ertürk & Tepeli, 2023b).

Working Memory Scale: The Working Memory Scale is a measurement tool developed by Ergül et al. in 2018 to determine the working memory performance of children from kindergarten to fourth grade. The Working Memory Scale consists of four sub-dimensions and nine sub-tests. There are four sub-dimensions in the WMIS, which consist of verbal memory and visual memory sub-domains; "verbal and visual short-term memory and verbal and visual working memory." The factor loading values of the scale were between 0.40 and 0.92 in the first application trial and between 0.49 and 0.93 in the second application trial. Test-retest reliability coefficients varied from 0.41 to 0.75; Cronbach's Alpha coefficient was found to vary from 0.66 to 0.84 (Ergül et al., 2018).

Procedure and Data Analysis

Data were collected in the 2023-2024 academic year. The data were evaluated in the SPSS26. To determine whether the data conformed to a normal distribution, the absolute skewness value was below ± 2.0 and kurtosis value was below 7.0. These two statistical criteria are important indicators to evaluate whether the data are symmetric and conform to normal distribution (Kim, 2013). The skewness value for the Theory of Mind Task Battery (TOMTB) was -0.217 and the kurtosis value was -0.354; the skewness value for the Metacognitive Knowledge Interview Form (McKI) was -0.649 and the kurtosis value was 1.416; and the skewness value for the Working Memory Scale was -0.027 and the kurtosis value was -0.165. Accordingly, the skewness and kurtosis values of the variables used in this study was found that the data conformed to normal distribution.

In the structural equation model, the mediating effect analysis is basically a regression analysis and is tested with regression assumptions. Before proceeding to the basic analyses, the prerequisites of the structural equation model, such as sample size, outlier analysis, multicollinearity problem and normality assumption, were reviewed (Ullman, 2013). After assessing the suitability of the data, the bootstrap technique was used to test the mediation models instead of Baron and Kenny's traditional method and the Sobel test. The bootstrap method allows modeling multiple regression equations by resampling from the original data, increasing the reliability of the results (Preacher et al., 2007; Zhao et al., 2010). In this study, the indirect effects of mediator variables were analyzed with the bootstrap technique. The absence of zero in the 95% confidence interval of the mediating variables indicates that the indirect effect is significant. Therefore, the bootstrap method was preferred for testing mediation models as it provides more reliable results (Preacher & Hayes, 2008). Statistical significance was accepted at $p<0.05$ level.

Ethics Committee Approval

This study was conducted in accordance with the Declaration of Helsinki. Ethical approval for this study was received from the Selçuk University Faculty of Health Sciences Non-interventional Clinical Research Ethics Committee with the decision number 2023/1155.

Findings

In this study, various statistical analyses were used to test the relationships between variables. Pearson correlation analysis was applied to determine the correlations between the basic variables in this study, which are theory of mind, working memory and metacognition levels. This analysis examined whether there were significant relationships between the variables. Then, a mediation analysis was performed to test the mediating role of metacognition in the relationship between theory of mind and working memory. In this analysis, PROCESS Macro was used to evaluate whether metacognition was a mediating variable. In the analysis process, the theory of mind was the independent variable, working memory as the dependent variable and metacognition as the mediating variable. The bootstrap method was used in the analyses, and the results were obtained from 5000 samples at a 95% confidence interval. The results were reported to show whether direct and indirect effects were statistically significant. In this context, the direction and magnitude of the relationship between the variables were presented in detail.

The descriptive statistics of the scales used in this study, which aimed to examine the mediating role of metacognition in the relationship between ToM and working memory, are given in Table 3.

Table 3. *Descriptive statistics of the scales (N=300).*

	X* ± *SS	***M (min-max)***
TOMTB	12.09 ± 1.98	12 (7-15)
McKI	18.51 ± 3.79	19 (3-28)
Working Memory Scale	39.58 ± 9.26	40 (16-66)

Table 3 shows that participants' average scores were as follows: Theory of Mind Task Battery (M = 12.09, SD = 1.98), Metacognitive Knowledge Interview Form (M = 18.51, SD = 3.79), and Working Memory Scale (M = 39.58, SD = 9.26). For all three scales, score ranges and medians indicated moderate to high performance across participants.

The relationships between the Working Memory Scale, Metacognitive Knowledge Interview Form (McKI), and Theory of Mind Task Battery (TOMTB) measurements are shown in Table 4.

Table 4. *Relationships between measurements (N=300).*

	TOMTB	McKI
McKI	**r=0.451 *p*<0.001**	
Working Memory Scale	**r=0.330 *p*<0.001**	**r=0.666 *p*<0.001**

Table 4 shows positive, statistically significant correlations between scale scores (p<0.05).

The results regarding the evaluation of the mediating effect of metacognition on the effect of theory of mind on working memory are given in Table 5

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Table 5. *Evaluation of the mediating effect of metacognition on the effect of theory of mind on working memory (N=300).*

Estimation Variables	**Result Variables**			
	McKI		**Working Memory Scale**	
	β*±*se	***p***	***β*±*se***	***p***
Stable	8.06 ± 1.21	**<0.001**	8.17 ± 2.65	**0.002**
TOMTB	0.86 ± 0.10	**<0.001**	0.17 ± 0.23	0.450
McKI	-	-	1.59 ± 0.12	**<0.001**
	R^2=0.204		R^2=0.445	
	F=76.141; ***p***<0.001		***F***=119.070; ***p***<0.001	

As shown in Table 5, the Theory of Mind Task Battery (TOMTB) had a statistically significant positive effect of 0.86 ± 0.10 units on the Metacognitive Knowledge Interview Form (McKI) (p<0.05). The TOMTB explained 20.4% of the change on the McKI in a statistically significant way (F=76.141; p<0.001). In the mediation model, the TOMTB had no statistically significant effect on the Working Memory Scale (p=0.450). McKI has a statistically significant positive effect of 1.59 ± 0.12 units on the Working Memory Scale (p<0.05). TOMTB and McKI explained 44.5% of the change in Working Memory Scale scores in a statistically significant way (F=119.070 p<0.001).

The effects of the theory of mind, metacognition, and working memory model are presented in Table 6.

Table 6. Effects between the theory of mind, metacognition, and working memory model(N=300).

Impacts	***β±se***	***p***	*95% Confidence Interval for β*	
			Lower Limit	Upper Limit
Total impact	1.54 ± 0.26	**<0.001**	1.038	2.044
Direct impact	0.17 ± 0.23	0.450	-0.274	0.617
Indirect impact	1.37 ± 0.19	-	0.991	1.768

Table 6 shows that without the Metacognitive Knowledge Interview Form (McKI), the Theory of Mind Task Battery (TOMTB) had a positive effect of 1.54 ± 0.26 units on the Working Memory Scale (p<0.05). When the direct effect was examined in the mediator model, it was seen that the TOMTB did not affect the Working Memory Scale (p<0.05). It was found that the TOMTB increased the Working Memory Scale scores by 1.37 ± 0.19 units with the mediating effect (indirect effect) of the McKI (p<0.05). The model created is presented in Figure 2.

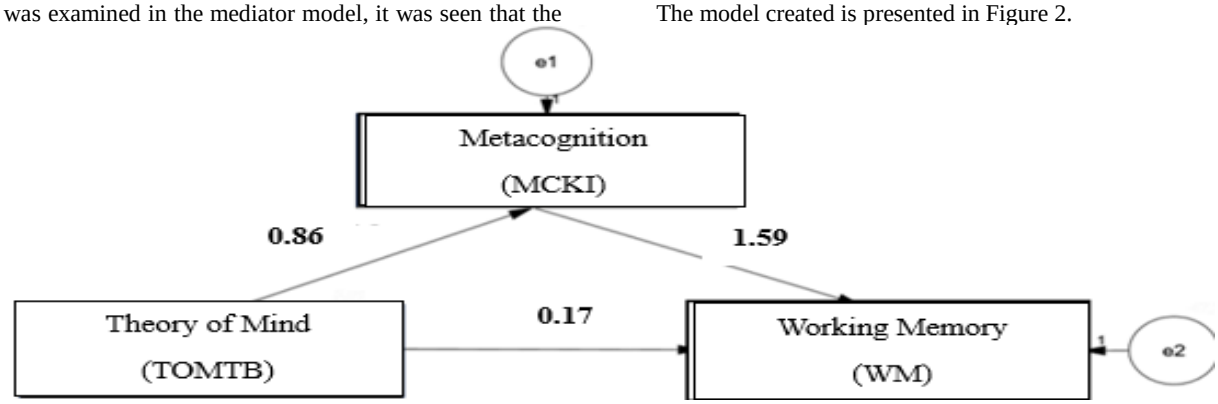

Figure 2. *Mediating effect model of metacognition in the effect of theory of mind on working memory.*

Discussion

The results of this study support the first hypothesis that ToM significantly predicts metacognition and has a significant effect on metacognition. Consistent with prior research, ToM has been linked to metacognition across cultural contexts (Symeonidou et al., 2024), associated with preschoolers' self-regulation (Mohamed, 2012), and shown to be influenced by metacognition (Aydın & Özgeldi, 2019).As a result, ToM contributes to the development of metacognitive skills; it supports the effective use of metacognition by facilitating individuals' understanding of their own and others' mental states. In this context, the relationship between ToM and metacognition is thought to be of critical importance in the development of individuals.

The results of this study support the second hypothesis that metacognition significantly predicts working memory and has a significant effect on working memory. Studies by Cornoldi et al. (2015) and Capodieci et al. (2019) found that metacognitive training improved working memory and academic performance. A broader evaluation of these findings suggests, that metacognition exerts a significant influence on children's working memory, particularly in facilitating their comprehension of learning processes.

The results of this study support the third hypothesis that ToM significantly predicts working memory and has a significant effect on working memory. The third hypothesis, asserting that ToM predicts working memory, was substantiated by findings from Gordon and Olson (1998) and He et al. (2019). In conclusion, the findings that ToM significantly affects working memory in children reveal the complexity of the interaction between these two cognitive processes. Research in this area is critical to better understanding the role of ToM and working memory in children's cognitive and social development.

The mediation analysis revealed that ToM influenced working memory indirectly through metacognition, suggesting ToM supports working memory by enhancing metacognitive processes, consistent with prior studies (Gordon & Olson, 1998; Mohamed, 2012; Cornoldi et al., 2015; Aydın & Özgeldi, 2019; Capodieci et al., 2019; He et al., 2019; Symeonidou et al., 2024). Theory of mind concerns understanding mental states, while metacognition involves monitoring and regulating one's cognitive processes; although distinct, they partially overlap in explaining cognitive development (Sodian, 2005).

Metacognition, described as 'knowing that one knows,' is considered part of theory of mind (Wellman, 1990). Working memory, a limited-capacity system for accessible information (Oberauer, 2005), is linked to creativity and recall (Diamond, 2013) and operates as a metacognitive process that both monitors and supports cognition (Carruthers, 2014).

When the research in the literature is evaluated in general, the theory of mind can express the ability of individuals to understand the thoughts, beliefs, and intentions of others. The effects of the theory of mind on working memory through metacognition play a critical role in understanding individuals' cognitive functions. While working memory is defined as the ability to store and process information temporarily, metacognition refers to individuals' ability to

monitor and organize their cognitive processes. In this context, examining the effects of the theory of mind on working memory through metacognition is critical to understanding how cognitive processes interact.

In this context, the evaluation of the findings obtained within a developmental framework contributes to the understanding of the causal relationships between the cognitive skills in question. In line with the model established in this study considering the age group, the theory of mind, which is effective in both cognitive and social development, supports metacognition, which is the child's ability to manage his/her own mental processes, and this in turn affects working memory, which is a more advanced cognitive skill. As a result of this research, it is seen that the theory of mind has an indirect effect on cognitive performance through metacognition. This result shows that the theory of mind has an indirect effect on social interactions and cognitive performance. This situation can also be interpreted as social and cognitive development having a multi-layered structure and progressing in a way that supports each other.

Conclusion and Recommendations

The findings in this study indicate that metacognition plays a mediating role in the relationship between ToM and working memory. ToM is related to the ability to understand the thoughts of others; metacognition is related to the individual's capacity to manage their thinking processes. The interplay between these skills enhances our understanding of cognitive functions. The development of ToM and metacognition can support working memory by positively affecting attention capacity. Educational settings that foster metacognition can reinforce the relationship between ToM and working memory.

As a result, the interaction between ToM and metacognition creates a dynamic structure that supports working memory and social cognition. A better understanding of this relationship can contribute to the development of individuals' cognitive and social skills.

Declarations

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Ethics Committee Approval
The study was conducted in accordance with the Declaration of Helsinki. Approval for the study was received from the Selçuk University Faculty of Health Sciences Non-Interventional Clinical Research Ethics Committee with the decision number 2023/1155.

Informed Consent Statement
Informed consent was obtained from the parents of all participants in the study.

Statement of Data Availability
Raw data supporting the conclusions of this article will be provided by the authors upon request.

Conflicts of Interest
No conflict.

Authors' Contributions
CKE contributed substantially to the planning, data collection, and writing of the manuscript. KT contributed to the data analysis, general writing, and editing of the manuscript. All authors read and approved the final version of the manuscript.

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