



## Pathways to social competence: motor skills and the mediating role of independence in early childhood education

*Caminos hacia la competencia social: habilidades motoras y el papel mediador de la independencia en la educación infantil temprana*

### Authors

Usman <sup>1</sup>  
 Arismunandar <sup>2</sup>  
 Rusmayadi <sup>3</sup>  
 Syamsuardi <sup>4</sup>  
 Muhammad Akil Musi <sup>5</sup>  
 Herlina <sup>6</sup>

<sup>1-6</sup> Makassar State  
 University (Indonesia)

Corresponding author:  
 Usman  
 usman@student.unm.ac.id

Received: 29-01-26  
 Accepted: 23-02-26

### How to cite in APA

Usman, U., Arismunandar, A., Rusmayadi, R., Saodi, S., Musi, M. A., & Hasan, H. (2026). Pathways to social competence: motor skills and the mediating role of independence in early childhood education: Pathways to social competence: motor skills and the mediating role of independence in early childhood education. *Retos*, 78, 382-393. <https://doi.org/10.47197/retos.v78.118679>

### Abstract

**Background.** The preschool period is a critical transition during which motor and social development lay the foundation for school readiness. Although the literature has extensively discussed the direct relationship between physical capabilities and social skills, the psychological mechanisms that bridge the two, particularly the role of independence, are still rarely explored holistically in the context of early childhood education.

The purpose of this study is to examine the role of independence as a mediator in the relationship between motor skills (gross and fine) and social skills in children aged 5-6 years. Using a cross-sectional explanatory survey design, this study involved 400 preschoolers in Makassar City, Indonesia, selected through a two-stage cluster sampling procedure. Data were collected through structured observation over three months by certified teachers using validated instruments. Data analysis was carried out with Partial Least Squares Structural Equation Modeling (PLS-SEM) using SmartPLS 4.0.

The results of the structural model analysis show that motor skills have a significant positive effect on independence and social skills. The crucial findings of this study reveal that independence functions as a significant partial mediator, with indirect influences through independence stronger than direct motor influences on social skills. The results of PLS-predict confirm that the model has intermediate category predictive power for child behavior development.

The conclusion of independence acts as an "accelerator" that transforms physical efficacy into social competence. The implications of this study emphasize the importance of a physical education curriculum that not only trains physical agility but also integrates autonomy stimulation and independent decision-making to optimally support children's social participation.

### Keywords

Motor skills, independence, social skills, early childhood education, PLS-SEM, mediating.

### Resumen

**Antecedentes.** El período preescolar es una transición crítica durante la cual el desarrollo motor y social sienta las bases para la preparación escolar. Aunque la literatura ha discutido ampliamente la relación directa entre las capacidades físicas y las habilidades sociales, los mecanismos psicológicos que unen a ambas, en particular el papel de la independencia, aún rara vez se exploran de manera holística en el contexto de la educación infantil.

El objetivo de este estudio es examinar el papel de la independencia como mediador en la relación entre las habilidades motoras (gruesas y finas) y las habilidades sociales en niños de 5 a 6 años. Mediante un diseño de encuesta explicativa transversal, este estudio contó con la participación de 400 niños en edad preescolar de la ciudad de Makassar (Indonesia), seleccionados mediante un procedimiento de muestreo por conglomerados en dos etapas. Los datos se recopilaron a través de una observación estructurada durante tres meses por parte de profesores titulados utilizando instrumentos validados. El análisis de los datos se llevó a cabo con el modelo de ecuaciones estructurales de mínimos cuadrados parciales (PLS-SEM) utilizando SmartPLS 4.0.

Los resultados del análisis del modelo estructural muestran que las habilidades motoras tienen un efecto positivo significativo en la independencia y las habilidades sociales. Las conclusiones cruciales de este estudio revelan que la independencia funciona como un mediador parcial significativo, con influencias indirectas a través de la independencia más fuertes que las influencias motoras directas en las habilidades sociales. Los resultados de PLS-predict confirman que el modelo tiene un poder predictivo de categoría intermedia para el desarrollo del comportamiento infantil.

La conclusión de la independencia actúa como un «acelerador» que transforma la eficacia física en competencia social. Las implicaciones de este estudio enfatizan la importancia de un plan de estudios de educación física que no solo entrene la agilidad física, sino que también integre la estimulación de la autonomía y la toma de decisiones independientes para apoyar de manera óptima la participación social de los niños.

### Palabras clave

Habilidades motoras, independencia, habilidades sociales, educación infantil, PLS-SEM, mediación.

## Introduction

Early childhood development is a critical phase that lays the foundations for physical, cognitive, social, and emotional development ((Harper et al., 2025; Pienaar et al., 2021; Sansi et al., 2021) and for self-regulation skills (Miller et al., 2023). Preschool age (5-6 years) is a crucial transition period towards primary education, during which school readiness encompasses language, cognitive, executive function, social-emotional, and motor domains (Choi et al., 2024; Davies et al., 2024). These domains develop interdependently; For example, motor competence is strongly correlated with executive function and problem-solving (Herman et al., 2025; Willoughby et al., 2021), while gross motor skills are closely related to pre-language and social development (Gallen et al., 2025). In this context, motor skills are the main foundation for children to actively interact with their physical environment (Lopes et al., 2025).

Motor skills in preschoolers, encompassing both gross and fine motor domains, are an integral part of motor competence (Kavanagh et al., 2019). Gross motor involves the coordination of the large muscles that are the basis for both locomotor (such as running and jumping) and non-locomotor (such as balance and stretching) abilities. Meanwhile, fine motor skills support manipulative abilities that involve eye-hand coordination to control objects (Katanić et al., 2025; Zhao et al., 2024).. These three elements of movement are locomotor, non-locomotor, and manipulative foundational movement skills (FMS) that have a dynamic relationship with physical activity throughout life (Foulkes et al., 2021; Roscoe et al., 2019). The age range of 3-8 years is considered a golden period for the development of these basic skills, serving as a foundation for learning complex movements in the future (Biino et al., 2025). Theoretically, this aligns with social cognitive theory (Bandura, 1977), which posits that mastering physical skills increases children's self-efficacy. The success of children in performing manipulative or skilled locomotor movements builds their confidence in their ability to control their actions, which then becomes the main modality in social interaction (Tao et al., 2025; Yin et al., 2025).

At the age of 5-6, children begin to consolidate cross-domain skills to adapt to formal learning structures and social demands (Turnbull et al., 2024; Zhoc et al., 2025). Social skills are the foundation for children to build wider relationships (Aydin et al., 2025; Guralnick & Bruder, 2025). The ability to interact effectively from an early age provides protection against stress and the negative impact of life events (Larivière-Bastien et al., 2022; Sharp et al., 2012; Sun et al., 2022). These skills include the ability to work together, share, and empathize (Dyson et al., 2021; Mahoney et al., 2021; Sørliie et al., 2021), which give rise to social competence that enables positive responses to others (Napolitano et al., 2021; Zhu et al., 2023).

Social skills are often rooted in a belief in self-worth, where independence becomes a capital of autonomy that encourages children to take the initiative more courageously in social games (Moreira et al., 2024; Ojeda-Troncoso & Campos-Campos, 2025). This relationship is explained by self-determination theory (Deci & Ryan, 2012), which holds that autonomy is a basic psychological need that must be met for children to function optimally. Through the regulation of motor stimulation (Rudd et al., 2019), Independence helps children manage behavior and follow the rules of the game (Blewitt et al., 2021; Lobo et al., 2025).

Independence at age 5-6 includes the ability to complete tasks autonomously without the full support of an adult (Chao & Cheng, 2025). This is very related to school readiness, executive functions, and self-regulation (Momba & Ostrov, 2025; Predy et al., 2025; Turnbull et al., 2024). Independence also supports cross-domain development, strengthening the child's capacity to regulate his or her actions (Schulz et al., 2024; Silva et al., 2025; Wu et al., 2024).

Although motor skills contribute significantly to cognitive and social outcomes, empirical evidence regarding holistic causality relationships is still limited (Hosokawa et al., 2024; Samawi et al., 2025). Previous literature has focused more on direct relationships or mediation mechanisms via executive functions and has tended to ignore the role of independence as a vital mediator in everyday behavior (Li et al., 2025). Exploration in the field of physical education often overlooks the roles of autonomy and self-efficacy, the core components of self-reliance, as an essential bridge connecting physical capacity with social competence (Hazizah et al., 2024; Serrano, 2024). Although recent research by Özen-Uyar et al., (2025) has highlighted the importance of teachers' support in fostering social competence during the transition phase, their focus is still on external intervention factors, so how children's internal independence transforms physical actions into adaptive social interactions remains a crucial gap that



needs to be explored (Rodríguez-Fernández et al., 2024). Moreover, research on the critical transition period for children aged 5-6 years remains very rare (Jalleli & Jarraya, 2025; McGuckin et al., 2024), underscoring the urgency of this research to develop a more integrative theoretical model.

In Indonesia, the integration between motor, independence, and social at the age of 5–6 years is still rarely empirically tested (Aghniarrahmah et al., 2022; Herman et al., 2025; Izza et al., 2025). This study aims to fill this gap by examining independence as a mediator and explaining how motor skills (gross and fine) support children's social development.

The hypotheses of this study are: (1) motor skills have a significant positive effect on independence and social skills; (2) independence has a significant positive effect on social skills; and (3) independence mediates the relationship between motor skills and social skills in children aged 5-6 years. The novelty of this research lies in integrating the theoretical foundations of Bandura and Deci & Ryan to holistically position independence as a behavioral bridge essential to school readiness and children's social participation in Indonesia.

## Method

### *Design, location, population and research sample*

This study uses a quantitative, cross-sectional, explanatory survey design. This study explores the influence of motor skills on social skills, with independence as a mediator. Makassar City was chosen because it is the largest city in the eastern region of Indonesia and is culturally diverse. There are 554 early childhood education institutions across 15 sub-districts. Sampling technique with two-stage cluster sampling, starting by determining schools based on region, and then choosing a school from each unit to be a sample. The technique provides accurate results across a wide area, so the population of children aged 5-6 years is estimated at 400 students.

### *Research variables and measurements*

To measure the variables, researchers developed instruments. Motor variables are adopted from Birkbauer et al. (2024), 3 items; independence adopted from Ottenbacher et al. (1996), 5 items; social skills adopted from Matson et al. (2010), 5 items. All variables use a Likert scale with 4 criteria: 1 (never), 2 (occasionally), 3 (often), 4 (consistent). The researcher used four categories to avoid neutral judgment. Before use, a validity test is conducted to ensure that each item on the observation sheet used in the questionnaire accurately measures the research variables. The criteria for reliability tests aim to measure the extent to which the instrument provides consistent and stable results when repeated measurements are made at different times or across groups. Motor variables with three items with values  $r_{\text{Count}} 0,905-0,906$  lebih besar dari  $r_{\text{tabel}}$  nilai Cronbach's Alpha sebesar 0,889 greater than 0.06. An independent variable with five value items,  $r_{\text{count}} 0,749-0,829$  greater than  $r_{\text{tabel}}$  nilai Cronbach's Alpha by 0,846 greater than 0.06. Social skills variables with values  $r_{\text{hitung}} 0,750-0,835$  lebih besar dari  $r_{\text{tabel}}$  Cronbach's Alpha value of 0.871 is greater than 0.06. All instruments demonstrate validity and reliability, making them suitable for use.

### *Data collection and analysis methods*

Before data collection, the researcher obtained a permit from the Makassar City Education Office. The researcher coordinates with schools and identifies teachers who can help with data collection, provided they are certified and have more than 5 years of teaching experience. Then the researcher distributes the research instrument to teachers who meet the criteria and are willing to participate. Data were collected using an observation sheet completed by teachers, who observed students' activities during school for 3 months. Data analysis was conducted using SmartPLS 4.0 through a PLS-SEM approach to examine the relationships between motor skills, independence, and social skills. This method was selected based on three primary considerations: (1) its suitability for predictive analysis of latent variables rather than purely theoretical confirmation (Hair et al., 2021); (2) its robust capability in handling complex mediation models; and (3) its non-parametric nature, which provides flexibility regarding data normality an assumption often difficult to satisfy in early childhood behavioral research. Furthermore, be-

yond assessing construct validity and indicator contributions, a full collinearity assessment was performed to ensure the model's immunity to common method bias by evaluating Variance Inflation Factors (VIFs) ((Kock, 2015).

## Results

### *Respondent demographic data*

This data provides an overview of respondents as additional information to enhance the research's credibility and to support further analysis and the application of research results to populations with similar characteristics.

Table 1. Characteristics of respondents

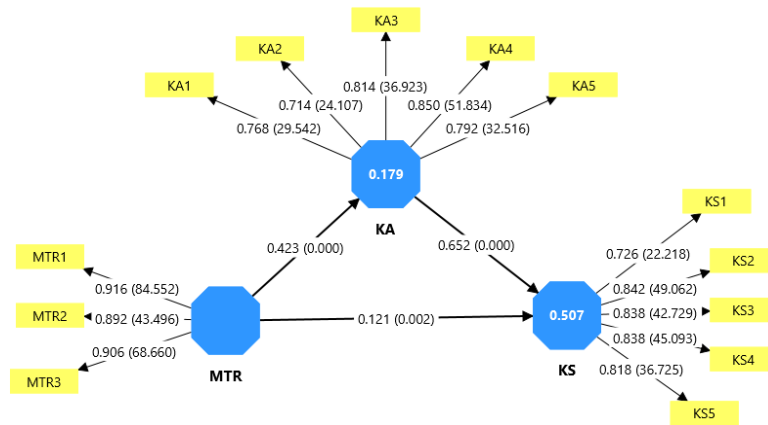
Variable	Frekwensi	%
Respondent Gender		
Male	207	51.75
Women	193	48.25
Child's Age		
5 year	186	46.5
6 yaer	214	53.5
Respondent's Parents' Work		
Civil Servant/TNI/Polri	138	34.5
Little Sword	10	2.5
Self-employed	19	4.8
Labor	3	.8
Kotrak Employees	113	28.3
Self-employed	117	29.3
Respondent Parent Education		
SMA	126	31.5
D3	48	12.0
Bachelor S1	164	41.0
Magister	59	14.8
Doctor S3	3	0.80
Total	400	100

The demographic characteristics of the 400 respondents, as summarized in Table 1, exhibit a balanced distribution. Regarding gender, the proportions are relatively equal (51.75% male), with the majority of children falling into the 6-year-old category (53.5%). Socioeconomically, the family profiles indicate substantial stability, with 92.1% of parents employed in the formal sector (public and private). Furthermore, this profile is bolstered by high educational attainment: 68.6% of parents hold higher education degrees (ranging from Diplomas to Doctoral degrees). These data reflect economically stable family backgrounds and high educational awareness, providing a significant foundation for the development of children's competencies

### *Model Measurement Evaluation*

The evaluation of the measurement model was conducted by assessing the loadings, internal consistency reliability, convergent validity, and discriminant validity. Indicators with a loading factor below 0.70 are removed from the model to maintain the construct's integrity (Hair et al., 2021). Internal consistency is confirmed by Cronbach's alpha and Composite Reliability (CR) values exceeding 0.70. Convergent validity is met with an Average Variance Extracted (AVE) value above 0.50. Meanwhile, discriminant validity was tested using two methods: HTMT (Heterotrait-Monotrait Ratio) with a threshold below 0.90, which is considered feasible for educational research (Sarstedt et al., 2019), as well as the Fornell-Larcker criterion, which ensures that the square root of AVE of each construct is higher than the correlation between other constructs (Fornell & Larcker, 1981). The structural relationships and the conceptual framework of this study are illustrated in the research model in Figure 1.

Figure 1. Path Model of the Influence of Motor Skills on Social Competence through Children's Independence



The results of the evaluation of the measurement model, including the loading factor values, reliability, and convergent validity for each construct, are summarized in Table 2.

Table 2. Construct reliability and validity

Variable	Indicator Code	Indicator	Loading factor	CA	CR	AVE
Child Independence (KA)	KA1	Have initiative	0.768	0.848	0.853	0.623
	KA2	Organize and manage activities	0.714			
	KA3	Using tools and materials independently	0.814			
	KA4	Interact and negotiate with friends	0.850			
	KA5	Make decisions and solve problems on the go	0.792			
Social Skills (KS)	KS1	Interpersonal skills	0.726	0.871	0.877	0.662
	KS2	Self-control	0.842			
	KS3	Cooperation	0.838			
	KS4	Empathy and care	0.838			
	KS5	Social communication	0.818			
Motor Skills (MTR)	MTR1	Locomotor abilities	0.916	0.890	0.899	0.819
	MTR2	Non-locomotor abilities	0.892			
	MTR3	Manipulative abilities	0.906			

Note MTR = Children's motor skills, KA = Child independence, KS = Children's social skills

The evaluation of the measurement model results, as detailed in Table 2, confirms that all three constructs exhibit high reliability and validity. The Cronbach's Alpha (CA) and Composite Reliability (CR) values for each variable are consistently above 0.70, indicating excellent internal consistency. Furthermore, the Average Variance Extracted (AVE) values exceed the 0.50 threshold (ranging from 0.623 to 0.819), proving that each latent variable explains a substantial portion of its indicators' variance. Additionally, all indicators exhibit strong loading factors (0.714 - 0.916), well above the recommended 0.70, which validates the empirical strength of the research instrument.

The discriminant validity test was performed to ensure that each construct is empirically different from the others, with the results summarized in Table 3 using the Heterotrait-Monotrait Ratio (HTMT) criteria and the Fornell-Larcker criteria.

Table 3. Kriteria discriminant validity

Variable	Kemandirian Anak	Keterampilan Sosial	Kemampuan Motorik
Heterotrait-monotrait ratio (HTMT) - Matrix			
<b>Child Independence</b>			
Social Skills	0.811		
Motor Skills	0.484	0.451	
<b>Fornell-Larcker criterion</b>			
Child Independence	0.789		
Social Skills	0.703	0.813	
Motor Skills	0.423	0.397	0.905



Based on the results presented in Table 3, the HTMT matrix analysis indicates that all values remain below the 0.90 threshold, with the highest correlation observed between social skills and children's independence (0.811). This fulfills both the liberal and the more conservative (0.85) criteria for discriminant validity. These findings are further corroborated by the Fornell-Larcker criterion, which demonstrates that the square root of the Average Variance Extracted (AVE) for each latent variable (diagonal values) consistently exceeds its correlation with any other construct (Fornell & Larcker, 1981). For instance, the square root of the AVE for motor ability (0.905) is substantially higher than its correlation with independence (0.423) and social skills (0.397). Consequently, it can be concluded that each construct possesses sufficient empirical distinctiveness, showing stronger associations with its own indicators than with those of other variables in the model.

Table 4. Results of Smart PLS Predictive Power Analysis

Item	PLS-SEM_RMSE	Q <sup>2</sup> predict	LM_RMSE	RMSE <sub>PLS</sub> - RMSE <sub>LM</sub>
KS1	0.573	0.114	0.573	0.000
KS2	0.554	0.103	0.557	-0.002
KS3	0.568	0.097	0.569	-0.002
KS4	0.537	0.101	0.535	0.002
KS5	0.544	0.091	0.546	-0.003

Based on Table 4, the Q2 predictive value is greater than 0, indicating that the model has good predictive power in the medium category, as the RMSE is lower than that of the LM model (Shmueli et al., 2019). Based on this data, it is recommended to use the instruments in the model to design interventions, as they have been proven to have predictive value for the medium. This provides a strong statistical basis that the proposed social-independence motor framework has high accuracy and can be applied in practical motor development interventions in predicting the future development of preschoolers' social behaviors.

After ascertaining the validity and reliability of the measurement model, a structural model is evaluated to test the research hypothesis. The results for path coefficients, statistical significance, and effect sizes are summarized in Table 5.

Table 5. Direct and Indirect Influence

Variable	Path coefficient $\beta$	P value	PCI		Sig	F <sup>2</sup>	VIF	R Square	Q Square
			5%	95%	Supported	Upsilon V			
Direct influence									
MTR -> KA	0.423	0.000	0.334	0.505	Yes	0.218	1.000	0.179	0.174
MTR -> KS	0.121	0.000	0.045	0.198	Yes	0.024	1.218		
KA -> KS	0.652	0.000	0.578	0.724	Yes	0.707	1.218	0.507	0.153
Indirect influence									
MTR -> KA -> KS	0.276	0.000	0.212	0.342	Yes	0.076			

Based on the results of the structural model test in Table 4, all direct and indirect influence hypotheses were proven to be significant ( $P < 0.001$ ). Motor ability (MTR) had a positive effect on independence (KA) ( $\beta = 0.423$ ) and social skills (KS) ( $\beta = 0.121$ ). The strongest influence was found in the relationship between independence and social skills ( $\beta = 0.652$ ,  $f^2 = 0.707$ ), which showed a large effect. In addition, the results of the mediation test showed that independence significantly mediated the relationship between motor ability and social skills ( $\beta = 0.276$ ,  $P = 0.000$ ). The reliability of this model is supported by a VIF value below 3.3 (1,000–1.218), indicating that it is free from collinearity and common method bias. Predictively, an R2 value of 0.507 indicates that this model explains 50.7% of the variance in social skills. Finally, positive Q2 values (0.174 and 0.153) confirm that the model has adequate predictive relevance for dependent variables.

## Discussion

This study shows that early childhood development operates through functional synergy, with motor maturity serving as the foundation for psychological independence and social success. These findings confirm that motor skills are a crucial determinant for children's independence. Mastery of locomotor and manipulative movements allows the child to navigate his or her physical environment, building self-efficacy through success in physical tasks (Capio & Eguia, 2021). This aligns with recent evidence from indicating that fundamental motor skills (FMS) are not merely biological maturation but rather educational goals that can be trained to encourage broader physical activity engagement (Romero-Martínez et al., 2024).

The central contribution of this study is the identification of Independence (KA) as a crucial mediator linking motor skills and social competence. These findings underscore that motor skills do not automatically trigger social skills; rather, work by building the foundation of independence first. In line with Bandura's Social Cognitive Theory, motor mastery increases the child's confidence in his abilities (self-efficacy), which manifests itself in independent behavior. Furthermore, through the lens of Self-Determination Theory (Deci & Ryan), independence serves to fulfill children's autonomy needs. When children feel capable of acting independently without strict supervision, they gain the confidence to navigate complex social dynamics.

In this context, independence acts as an 'accelerator' that converts physical (motor) potential into social capital (social competence). Independence serves as leverage that allows children to enter educational routines and social activities with confidence (Molinero-González et al., 2023). Studies in the context of physical education at show that motion-based activities, such as "motor stories", can be specifically designed to stimulate cooperation and empathy (Wibowo, 2024). When children have the functional capacity to act autonomously, they gain greater access to the "social laboratory" in the playground, where social rules are learned through natural interactions (Irvin et al., 2025; Mercê et al., 2025).

Despite its significant theoretical contributions, this research has some limitations that provide a basis for future research. The cross-sectional design used limits the ability to draw long-term causal inferences about the dynamics of the developmental cascade among motor, independence, and social competence. In addition, the generalization of the findings is limited to the urban context in Makassar. Comparative studies in rural areas are needed to capture variation in parenting patterns and cultural factors more inclusively. The model also does not yet incorporate critical internal variables, such as language development, emotional intelligence, and nutritional status, which may act as moderators in the motor-social relationship. Consequently, future research should adopt longitudinal and multivariate designs to validate the stability of these mediation mechanisms within more complex and socio-culturally diverse developmental ecosystems (Abdelkefi et al., 2025; Quenzer-Alfred, 2025). From a practical perspective, these findings urge a repositioning of physical education programs at the preschool level towards a more holistic approach. The early childhood education curriculum should no longer be limited to the development of physical agility alone; it must explicitly integrate values of independent decision-making and problem-solving skills (Sutapa et al., 2021). By reinforcing the independence aspect of physical activity, educators can create a more effective pathway for children to achieve sustainable social success.

## Conclusions

The results of the study show that social competence in early childhood is not formed instantly but rather develops through an integrated developmental pathway linking physical capabilities and psychological autonomy. Key findings suggest that motor skills, both gross and subtle, are fundamental predictors of children's independence. Furthermore, independence was identified as a crucial mediator that accelerates the transformation of physical skills into tangible social skills. This confirms that children with high movement maturity and self-autonomy will be more effective at navigating peer interactions, adhering to social rules, and building pro-social relationships in the school environment. Methodologically, the main strength of this model lies in its medium-range predictive power. This predictive advantage demonstrates that the proposed model has stable, valid predictive accuracy for children's future



social behavior based on motor and independence variables. Theoretically, integrating social cognitive theory and self-determination theory in this model provides a new architecture for understanding the holistic development of children during the preschool transition period, one that is not only correlational but also highly practical.

## Acknowledgements

The author expresses his deepest gratitude for the continued support during this research. We also express our sincere appreciation to the teachers for their cooperation and assistance in the data collection process. In addition, we would like to thank the colleagues who carefully examined this manuscript, as well as the translators, for their assistance in preparing this draft for publication and ensuring it was well organized.

## Financing

This research is part of the first author's doctoral dissertation at Makassar State University, Indonesia. The author would like to thank the promoter and co-promoter, as well as internal and external testers.

## References

- Abdelkefi, I., Jarraya, S., Masmoudi, L., Jallali, D., Ben Mansour, N., & Jarraya, M. (2025). The Effectiveness of Motor Imagery Training in Improving Motor Skills in Preschool Children: A Randomized Controlled Study. *Perceptual and Motor Skills*, 00315125251391881. <https://doi.org/10.1177/00315125251391881>
- Aghniarrahmah, C., Fridani, L., & Supena, A. (2022). Perkembangan Kemandirian dan Keterampilan Sosial Anak Usia 5-6 Tahun dalam Pengasuhan Dual Career Family. *Jurnal Obsesi : Jurnal Pendidikan Anak Usia Dini*, 6(1), 389–400. <https://doi.org/10.31004/obsesi.v6i1.1319>
- Aydın, S., Sak, R., & Şahin-Sak, İ. T. (2025). Interrelationship of Preschoolers' Gross Motor Skills, Digital Game Addiction Tendency, and Parents' Parenting Styles. *Children*, 12(7), 932. <https://doi.org/10.3390/children12070932>
- Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review*, 84(2), 191–215. <https://doi.org/10.1037/0033-295X.84.2.191>
- Biino, V., Pesce, C., & Martins, C. (2025). Motor Skill Development at Preschool Age in Girls and Boys: The Role of Outdoor Free Play. *Children*, 12(5), 594. <https://doi.org/10.3390/children12050594>
- Birklbauer, J., Gniewosz, B., Freudenthaler, T., Birklbauer, A., Pötzelsberger, B., Wiesinger, H.-P., Weghuber, D., & Ring-Dimitriou, S. (2024). A Fundamental Movement Skill Test for Preschool Children With and Without Overweight: The SALTO Test Battery. <https://doi.org/10.1123/pes.2024-0076>
- Blewitt, C., O'Connor, A., Morris, H., Nolan, A., Mousa, A., Green, R., Ifanti, A., Jackson, K., & Skouteris, H. (2021). "It's Embedded in What We Do for Every Child": A Qualitative Exploration of Early Childhood Educators' Perspectives on Supporting Children's Social and Emotional Learning. *International Journal of Environmental Research and Public Health*, 18(4), 1530. <https://doi.org/10.3390/ijerph18041530>
- Capio, C. M., & Eguia, K. F. (2021). Movement skills, perception, and physical activity of young children: A mediation analysis. *Pediatrics International*, 63(4), 442–447. <https://doi.org/10.1111/ped.14436>
- Chao, M., & Cheng, C. (2025). The Developmental Trajectory of Emotion Regulation in Taiwanese Children: Secure Attachment Relationships and Children's Independence. *Infant and Child Development*, 34(3). <https://doi.org/10.1002/icd.70031>
- Choi, J.-Y., Betancur, L. C., & Rouse, H. L. (2024). Head Start Children's Dual Enrollment in State Pre-K: Prevalence and Child Outcomes. *AERA Open*, 10, 23328584241255612. <https://doi.org/10.1177/23328584241255612>
- Davies, C., Kong, S. P., Hendry, A., Archer, N., McGillion, M., & Gonzalez-Gomez, N. (2024). Sustained benefits of early childhood education and care (ECEC) for young children's development during



- COVID-19. *Journal of Early Childhood Research*, 22(2), 238–257. <https://doi.org/10.1177/1476718X231213488>
- Deci, E. L., & Ryan, R. M. (2012). Self-determination theory. *Handbook of Theories of Social Psychology*, 1(20), 416–436.
- Dyson, B., Howley, D., & Shen, Y. (2021). ‘Being a team, working together, and being kind’: Primary students’ perspectives of cooperative learning’s contribution to their social and emotional learning. *Physical Education and Sport Pedagogy*, 26(2), 137–154. <https://doi.org/10.1080/17408989.2020.1779683>
- Fornell, C., & Larcker, D. F. (1981). Evaluating Structural Equation Models with Unobservable Variables and Measurement Error. *Journal of Marketing Research*, 18(1), 39–50. <https://doi.org/10.1177/002224378101800104>
- Foulkes, J., Knowles, Z., Fairclough, S. J., Stratton, G., O’Dwyer, M., & Foweather, L. (2021). Is Foundational Movement Skill Competency Important for Keeping Children Physically Active and at a Healthy Weight? *International Journal of Environmental Research and Public Health*, 19(1), 105. <https://doi.org/10.3390/ijerph19010105>
- Gallen, A., Taylor, E., Salmi, J., Haataja, L., Vanhatalo, S., & Airaksinen, M. (2025). Early Gross Motor Performance Is Associated With Concurrent Prelinguistic and Social Development. *Pediatric Research*, 98(3), 1016–1022. <https://doi.org/10.1038/s41390-025-03832-5>
- Guralnick, M. J., & Bruder, M. B. (2025). Inclusion in Preschool as a Catalyst to Enhance the Quality of Comprehensive Community-Based Early Childhood Programs. *Infants & Young Children*, 38(4), 262–279. <https://doi.org/10.1097/IYC.0000000000000304>
- Hair, J. F., Hult, G. T. M., Ringle, C. M., Sarstedt, M., Danks, N. P., & Ray, S. (2021). *Partial Least Squares Structural Equation Modeling (PLS-SEM) Using R: A Workbook*. Springer International Publishing. <https://doi.org/10.1007/978-3-030-80519-7>
- Harper, E., McGrath-Champ, S., & Wilson, R. (2025). Perspectives on Teachers’ Work in Australian Early Childhood Education and Care Settings: Evidence and Ecology. *Early Childhood Education Journal*, 53(7), 2359–2372. <https://doi.org/10.1007/s10643-024-01745-2>
- Hazizah, N., Rusdinal, R., Handrianto, C., Ismaniar, I., & Rahman, M. A. (2024). Warrior Kids Games on Improving the Self-Efficacy Abilities and Fine Motor Skills of 5–6 Years-Old Children. *Retos*, 56, 639–647. <https://doi.org/10.47197/retos.v56.104892>
- Herman, H., Sultan, S., Suardi, S., Ahmar, A. S., & Khaeruddin, K. (2025). Social emotional learning in pre-service early childhood teachers: The key role of academic achievement, ICT competence and socioeconomic status. *Cogent Education*, 12(1), 2586315. <https://doi.org/10.1080/2331186X.2025.2586315>
- Hosokawa, R., Matsumoto, Y., Nishida, C., Funato, K., & Mitani, A. (2024). Enhancing social-emotional skills in early childhood: Intervention study on the effectiveness of social and emotional learning. *BMC Psychology*, 12, 761. <https://doi.org/10.1186/s40359-024-02280-w>
- Irvin, D., Rous, B., Luo, Y., Lane, J. D., Hadley, E. B., Rojas, J. P., Irvin, A., & Bergstrom, H. C. (2025). Advances in Measuring the Intersection of Talk and Contextual Features on the Early Childhood Playground. *Topics in Early Childhood Special Education*. <https://doi.org/10.1177/02711214251324615>
- Izza, H., Fitriani, H., & Kuswardani, M. E. (2025). Kemadirian Anak Usia Dini pada Program Full-day dan Reguler: Studi Kuantitatif Komparatif. *Jurnal Obsesi: Jurnal Pendidikan Anak Usia Dini*, 9(5), 2271–2277. <https://doi.org/10.31004/obsesi.v9i5.7429>
- Jalleli, D., & Jarraya, S. (2025). The Effect of a Short-Term Mindfulness Program on Motor Skills and on Psychological and Social Behavior in Preschool Children: A Randomized Controlled Trial. *Perceptual and Motor Skills*, 00315125241270657. <https://doi.org/10.1177/00315125241270657>
- Katanić, B., Aleksić-Veljković, A., Radaković, R., Mujanović, R., & Prvulović, N. (2025). The Association Between Motor Abilities and Movement Skills With Cognitive Abilities in Preschool Children. *Retos*, 65, 579–588. <https://doi.org/10.47197/retos.v65.111375>
- Kavanagh, J., Issartel, J., & Moran, K. (2019). How Actual Motor Competence and Perceived Motor Competence Influence Motor-skill Engagement of a Novel Cycling Task. *Scandinavian Journal of Medicine and Science in Sports*, 29(10), 1583–1590. <https://doi.org/10.1111/sms.13492>
- Kock, N. (2015). Common Method Bias in PLS-SEM: A Full Collinearity Assessment Approach. *International Journal of E-Collaboration (IJec)*, 11(4), 1–10. <https://doi.org/10.4018/ijec.2015100101>



- Larivière-Bastien, D., Aubuchon, O., Blondin, A., Dupont, D., Libenstein, J., Séguin, F., Tremblay, A., Zarglayoun, H., Herba, C. M., & Beauchamp, M. H. (2022). Children's perspectives on friendships and socialization during the COVID-19 pandemic: A qualitative approach. *Child: Care, Health and Development*, 48(6), 1017–1030. <https://doi.org/10.1111/cch.12998>
- Li, Y., Wu, X., Ye, D., Zuo, J., & Liu, L. (2025). Research progress on the relationship between fine motor skills and academic ability in children: A systematic review and meta-analysis. *Frontiers in Sports and Active Living*, 6. <https://doi.org/10.3389/fspor.2024.1386967>
- Lobo, E., Mukherjee, D., Choudhury, P. K., Babu, G. R., Srinivas, P. N., & Onno C. P. van Schayck. (2025). Home-Learning Environment and Cognitive and Academic Outcomes Among Children Aged 4–8 years: A Cross-Sectional Study From South India. *Dialogues in Health*, 7, 100238. <https://doi.org/10.1016/j.dialog.2025.100238>
- Lopes, N., Jacinto, M., Monteiro, D., Matos, R., & Ibáñez, S. J. (2025). Effects of a Twelve-Week Complementary Sports Program to Athletics Training on Motor Competence in Children Aged 6 to 10 Years Old—A Study Protocol. *Healthcare*, 13(17), 2111. <https://doi.org/10.3390/healthcare13172111>
- Mahoney, J. L., Weissberg, R. P., Greenberg, M. T., Dusenbury, L., Jagers, R. J., Niemi, K., Schlinger, M., Schlund, J., Shriver, T. P., VanAusdal, K., & Yoder, N. (2021). Systemic social and emotional learning: Promoting educational success for all preschool to high school students. *American Psychologist*, 76(7), 1128–1142. <https://doi.org/10.1037/amp0000701>
- Matson, J. L., Neal, D., Fodstad, J. C., Hess, J. A., Mahan, S., & Rivet, T. T. (2010). Reliability and Validity of the Matson Evaluation of Social Skills With Youngsters. *Behavior Modification*, 34(6), 539–558. <https://doi.org/10.1177/0145445510384844>
- McGuckin, T., Turner, D., Jones, T., Crowther, F., Eagers, J., & Connor, J. (2024). Impact of a fundamental movement skills program on educator practice in early learning centres. *Discover Education*, 3(1), 94. <https://doi.org/10.1007/s44217-024-00193-9>
- Memba, G. V., & Ostrov, J. M. (2025). Executive Functioning Across the Transition to Kindergarten: Links With Social and Academic Outcomes in Early Childhood. *Social Development*, 34(1), e12788. <https://doi.org/10.1111/sode.12788>
- Mercê, C., Bernardino, S., Saramago, N., Branco, M., & Catela, D. (2025). A Quasi-Experimental Hip-Hop-Based Program to Improve Motor Competence and Physical Activity in Preschoolers in Portugal: The “Grow+” Program. *Healthcare*, 13(19), 2518. <https://doi.org/10.3390/healthcare13192518>
- Miller, A. L., Palmer, K. K., Wang, L., Wang, C., Riley, H. O., McClelland, M. M., & Robinson, L. E. (2023). Mastery-oriented motor competence intervention improves behavioral but not cognitive self-regulation in head start preschoolers: Randomized controlled trial results. *Scandinavian Journal of Medicine & Science in Sports*, 33(5), 725–736. <https://doi.org/10.1111/sms.14294>
- Molinero-González, P., Martín-Antón, L. J., Carbonero-Martín, M. Á., Arteaga-Cedeño, W. L., & Rodríguez-Sáez, J. L. (2023). The Effectiveness of an Intervention Programme for Reducing Peer Rejection in Early Childhood Education. *Children*, 10(11), 1826. <https://doi.org/10.3390/children10111826>
- Moreira, J. S., Ferreira, P. C., & Simão, A. M. V. (2024). Fostering Self-Regulated Learning in Preschool Through Dynamic Assessment Methodologies. *Plos One*, 19(3), e0298759. <https://doi.org/10.1371/journal.pone.0298759>
- Napolitano, C. M., Sewell, M. N., Yoon, H. J., Soto, C. J., & Roberts, B. W. (2021). Social, Emotional, and Behavioral Skills: An Integrative Model of the Skills Associated With Success During Adolescence and Across the Life Span. *Frontiers in Education*, 6. <https://doi.org/10.3389/educ.2021.679561>
- Ojeda-Troncoso, N., & Campos-Campos, K. (2025). Adapted Sports-Based Games With Cooperative and Competitive Approaches on Social and Motor Skills in Early Primary School Students. *Perceptual and Motor Skills*, 132(6), 1332–1350. <https://doi.org/10.1177/00315125251342622>
- Ottenbacher, K. J., Taylor, E. T., Msall, M. E., Braun, S., Lane, S. J., Granger, C. V., Lyons, N., & Duffy, L. C. (1996). The Stability And Equivalence Reliability Of The Functional Independence Measure For Children (WeeFIM)®. *Developmental Medicine & Child Neurology*, 38(10), 907–916. <https://doi.org/10.1111/j.1469-8749.1996.tb15047.x>
- Özen-Uyar, R., Aslan, D., Reinke, W. M., & Aktaş-Arnas, Y. (2025). Training and coaching early childhood teachers to foster social, emotional, and behavioral competence of children in Turkey. *School Psychology*, 40(3), 309–322. <https://doi.org/10.1037/spq0000625>

- Pienaar, A. E., Gericke, C., & Plessis, W. du. (2021). Competency in Object Control Skills at an Early Age Benefit Future Movement Application: Longitudinal Data from the NW-CHILD Study. *International Journal of Environmental Research and Public Health*, 18(4), 1648. <https://doi.org/10.3390/ijerph18041648>
- Predy, L. K., Vrantsidis, D., Khoei, M., Ali, N., & Wiebe, S. A. (2025). Separable but Correlated: The Role of Executive Functions and Effortful Control in the Transition to School Age. *Behavioral Sciences*, 15(7), 845. <https://doi.org/10.3390/bs15070845>
- Quenzer-Alfred, C. (2025). Transition at a standstill: Preschoolers' motor development during the COVID-19 pandemic. *Early Years*, 45(3-4), 456-471. <https://doi.org/10.1080/09575146.2024.2372614>
- Rodríguez-Fernández, J. E., Pereira, V., & Pereira, B. (2024). The Playground as a Laboratory for Playful Practices and Social Relations. *Retos*, 60, 1319-1326. <https://doi.org/10.47197/retos.v60.108095>
- Romero-Martínez, J., Menescardi, C., García-Massó, X., & Estevan, I. (2024). Efectos De La Actividad Física Durante Las Clases Sobre La Alfabetización Motriz: Una Revisión Sistemática (Effects of Class-Based Physical Activity in Physical Literacy: A Systematic Review). *Retos*, 52, 311-322. <https://doi.org/10.47197/retos.v52.100143>
- Roscoe, C. M. P., James, R. S., & Duncan, M. (2019). Accelerometer-Based Physical Activity Levels, Fundamental Movement Skills and Weight Status in British Preschool Children From a Deprived Area. *European Journal of Pediatrics*, 178(7), 1043-1052. <https://doi.org/10.1007/s00431-019-03390-z>
- Rudd, J., O'Callaghan, L., & Williams, J. (2019). Physical Education Pedagogies Built Upon Theories of Movement Learning: How Can Environmental Constraints Be Manipulated to Improve Children's Executive Function and Self-Regulation Skills? *International Journal of Environmental Research and Public Health*, 16(9), 1630. <https://doi.org/10.3390/ijerph16091630>
- Samawi, A., Yafie, E., & Astuti, W. (2025). A model of physical literacy, parental involvement, and social factors on motor development in children with social development as a moderator. *Retos*, 66, 788-802. <https://doi.org/10.47197/retos.v66.113168>
- Sansi, A., Nalbant, S., & Ozer, D. (2021). Effects of an Inclusive Physical Activity Program on the Motor Skills, Social Skills and Attitudes of Students with and without Autism Spectrum Disorder. *Journal of Autism and Developmental Disorders*, 51(7), 2254-2270. <https://doi.org/10.1007/s10803-020-04693-z>
- Sarstedt, M., Hair, J. F., Cheah, J. H., Becker, J. M., & Ringle, C. M. (2019). How to specify, estimate, and validate higher-order constructs in PLS-SEM. *Australasian Marketing Journal*, 27(3), 197-211. <https://doi.org/10.1016/j.ausmj.2019.05.003>
- Schulz, M. L., Wood, C. E., Fogarty, A., Brown, S. J., Gartland, D., & Giallo, R. (2024). Intimate partner violence exposure during infancy and social functioning in middle childhood: An Australian mother and child cohort study. *Child Development*, 95(3), 817-830. <https://doi.org/10.1111/cdev.14032>
- Serrano, D. G. (2024). La Escuela Reggio Emilia Aplicada a Las Clases De Natación en Educación Física Con Niños Y Niñas De Hasta Dos Años De Edad (The Reggio Emilia Approach Applied to Swimming Classes in Physical Education With Boys and Girls Up to Two Years Old). *Retos*, 56, 200-207. <https://doi.org/10.47197/retos.v56.102973>
- Sharp, C., Fonagy, P., & Allen, J. G. (2012). Posttraumatic stress disorder: A social-cognitive perspective. *Clinical Psychology: Science and Practice*, 19(3), 229-240. <https://doi.org/10.1111/cpsp.12002>
- Silva, G. G., Filho, M. A. R., Carlos Dario da Silva Costa, Stela Regina Pedrosa Vilela Torres de Carvalho, João Daniel de Souza Menezes, Silva, M. Q. d., Martinez, W. D., Gonçalves, B. C., Natália Almeida de Arnaldo Silva Rodriguez Castro, Luíz Vianney Saldanha Cidrão Nunes, Santos, E. R. d., Cristóvão, H. L. G., Werneck, A. L., Quitério, A. B., Lopes, S. M. M., Vaz-Oliani, D. C. M., Fácio, F. N., Fucuta, P. d. S., Alba Regina de Abreu Lima, ... Andre, J. C. (2025). How Learning Styles Characterize Medical Students, Surgical Residents, Medical Staff, and General Surgery Teachers While Learning Surgery: Scoping Review. *Jmir Medical Education*, 11, e66766-e66766. <https://doi.org/10.2196/66766>
- Sørli, M.-A., Hagen, K. A., & Nordahl, K. B. (2021). Development of social skills during middle childhood: Growth trajectories and school-related predictors. *International Journal of School & Educational Psychology*, 9(sup1), S69-S87. <https://doi.org/10.1080/21683603.2020.1744492>



- Sun, J., Singletary, B., Jiang, H., Justice, L. M., Lin, T.-J., & Purtell, K. M. (2022). Child behavior problems during COVID-19: Associations with parent distress and child social-emotional skills. *Journal of Applied Developmental Psychology, 78*, 101375. <https://doi.org/10.1016/j.appdev.2021.101375>
- Sutapa, P., Pratama, K. W., Rosly, M. M., Ali, S. K. S., & Karakauki, M. (2021). Improving Motor Skills in Early Childhood through Goal-Oriented Play Activity. *Children, 8*(11), 994. <https://doi.org/10.3390/children8110994>
- Tao, Y., Zhang, Y., Qian, H., & Cao, Z. (2025). Long term effects of physical activity types on executive functions in school aged children. *Scientific Reports, 15*(1), 30303. <https://doi.org/10.1038/s41598-025-09674-9>
- Turnbull, K. L. P., DeCoster, J., Downer, J. T., & Williford, A. P. (2024). Elucidating linkages of executive functioning to school readiness skill gains: The mediating role of behavioral engagement in the PreK classroom. *Early Childhood Research Quarterly, 69*, 38–48. <https://doi.org/10.1016/j.ecresq.2024.07.001>
- Wibowo, Moch. S. R. (2024). The Effect of Self-Efficacy, Social Support, and Achievement Motivation on Archery Athlete's Performace. *Retos, 54*, 348–354. <https://doi.org/10.47197/retos.v54.102211>
- Willoughby, M. T., Hudson, K., Hong, Y., & Wylie, A. (2021). Improvements in Motor Competence Skills Are Associated With Improvements in Executive Function and Math Problem-Solving Skills in Early Childhood. *Developmental Psychology, 57*(9), 1463–1470. <https://doi.org/10.1037/dev0001223>
- Wu, H., Eungpinichpong, W., Ruan, H., Chen, W., Yang, Y., & Dong, X. (2024). Towards Sustainable Early Education Practices: A Quasi-Experimental Study on the Effects of Kindergarten Physical Education Programs on Fundamental Movement Skills and Self-Regulation in Haikou City, China. *Sustainability, 16*(4), 1400. <https://doi.org/10.3390/su16041400>
- Yin, X., Zhang, D., Shen, Y., Wang, Y., Wang, Z., & Liu, Y. (2025). Effectiveness of school-based interventions on fundamental movement skills in children: A systematic review and meta-analysis. *BMC Public Health, 25*(1), 1522. <https://doi.org/10.1186/s12889-025-22696-2>
- Zhao, P., Ma, K., Ji, Z., & Jiang, G. (2024). Effects of Task Interference on Kinematics and Dual-Task Cost of Running in Early Childhood. *Sensors, 24*(5), 1534. <https://doi.org/10.3390/s24051534>
- Zhoc, K. C., Tse, J. K., & King, R. B. (2025). The importance of social and emotional learning in facilitating positive transitions from kindergarten to primary school in Hong Kong. *Journal of Early Childhood Research, 23*(4), 464–479. <https://doi.org/10.1177/1476718X251349938>
- Zhu, D., Chen, Y., Li, L., & Dunsmore, J. C. (2023). Family Functioning, Emotion Socialization, and Children's Social Competence: Gender-Specific Effects in Chinese Families. *Journal of Child and Family Studies, 32*(1), 257–271. <https://doi.org/10.1007/s10826-022-02480-1>

### Authors' and translators' details:

Usman	usman@student.unm.ac.id	Author
Arismunandar	arismunandar@unm.ac.id	Author
Rusmayadi	rusmayadi@unm.ac.id	Author
Syamsuardi	syamsuardi@unm.ac.id	Author
Herlina	herlina@unm.ac.id	Author
Muhammad Akil Musi	m.akil.musi@unm.ac.id	Author

