Volume 7 Nomor 2 (2026) Pages 348–359
Hadlonah: Jurnal Pendidikan dan Pengasuhan Anak
Email Journal :jurnalhadlonahuibbc@gmail.com
Web Journal : https://jurnal.uibbc.ac.id/index.php/hadlonah

Changes in Gross Motor Skills Following Movement and Song Activities mong Group B Children at TK PKK Karawana

Adriyani Adriyani [1]✉, Shofiyanti Nur Zuama[2], Mohamad Akbar[3], Humaedi Humaedi[4], Mutia Nandika[5], Nailah Syahutri[6]

[1,2,3,4,5,6] Early Childhood Education Teacher Education, Faculty of Teacher Training and Education Tadulako University, Palu

Email: adriy067@gmail.com✉

Submitted: 2026-08-17; Accepted: 2026-10-27; Published: 2026-11-10

Abstract

This study described changes in observed gross motor development categories following movement-and-song activities among 15 Group B children at TK PKK Karawana, Sigi Regency. A quantitative one-group pretest-posttest classroom study was conducted in April-May 2026. Teacher-guided activities used "Pelangi-Pelangi," "Aram Sam-Sam," and "Lampu Merah, Lampu Hijau" to provide practice in flexibility, agility, and balance. Each domain was assessed using a four-category classroom observation rubric scored from 1 (Not Yet Developed) to 4 (Very Well Developed). Frequencies, percentages, and coded means were summarized descriptively. Before the activities, 9 of 15 children (60.00%) were rated below Developed as Expected in flexibility, 11 (73.33%) in agility, and 13 (86.67%) in balance. At posttest, all children were rated at least Developed as Expected in flexibility and agility, whereas three (20.00%) remained Beginning to Develop in balance. Eight children (53.33%) were rated Very Well Developed in each domain at posttest. Mean coded domain scores increased by 1.27, 1.60, and 1.40 points for flexibility, agility, and balance, respectively. Combined scores reconstructed from the category frequencies averaged 6.13 at pretest and 10.40 at posttest, a descriptive difference of 4.27 points. These findings indicate higher classroom observation ratings over the study period, not an established causal effect. Interpretation is limited by the single-group design, small sample, and an observation rubric that lacked documented validation and combined motor performance with affective participation.

Keywords: *Movement and Song; Gross Motor Skills; Early Childhood; Flexibility; Agility; Balance.*

Copyright © 2026 Authors

This is an open access article under the CC BY-SA license.

P-ISSN : 2549-0141 | E-ISSN : 2746-6779

INTRODUCTION

Early childhood education offers opportunities to develop physical, cognitive, language, and social capacities through direct experience. Children differ in developmental readiness and benefit from learning experiences matched to their abilities (Nurasyiah & Atikah, 2023; Tukly et al., 2025). Gross motor skills support movement, changes of direction, coordination of large muscle groups, and postural stability during preschool activities. Evidence syntheses suggest that structured physical activity and active play can support fundamental movement skills, although outcomes vary across tasks and programmes (Chen et al., 2024; Liu et al., 2025). Evaluating particular movement domains is therefore important when examining classroom activities.

Movement-and-song activities combine bodily movement with rhythmic, musical, and verbal cues. In Indonesian early-childhood settings, they are used to organize repeated motor practice in an engaging classroom format (Dianti & Nursafitri, 2024; Rohimah & Prianti, 2024). Teacher demonstration and imitation are frequently described as practical elements of implementation (Kevin Julian et al., 2024; Lanapu & Kristsuana, 2025; Togatorop & Lestari, 2022). Such classroom accounts provide a teaching rationale but do not, on their own, establish intervention efficacy.

Movement cues may help children start, stop, or change an action; teacher demonstrations provide a model, and repetition allows further attempts. These processes offer a plausible explanation for activity-related learning but were not separately measured here. Music-and-movement studies have examined rhythm and other learning outcomes, with benefits depending on the domain assessed (Frey et al., 2022; Laure & Habe, 2024). Guided-play research similarly emphasizes the role of adult support and learning objectives (Skene et al., 2022).

The three classroom activities emphasized different observable demands. "Pelangi-Pelangi" accompanied bending, arm swinging, stretching, and turning associated with flexibility. "Aram Sam-Sam" involved locomotion, changes of direction, hand-body coordination, and rapid responses, emphasizing agility. "Lampu Merah, Lampu Hijau" involved moving, stopping, holding a position, and restarting, emphasizing balance. The demands overlap across domains: turning also requires coordination and stabilization, and stop-go responses involve attention. The song-domain pairings therefore describe the emphasis of the classroom tasks rather than isolated song-specific effects.

Indonesian studies describe favorable classroom responses to rhythmic gymnastics, movement videos, and activities combining movement with songs (Lismayani, 2023; Maya Tahtani & Sunaryo, 2025; Mayar et al., 2022). Controlled studies have also reported selected gains following rhythmic or action-song activities (Chatzopoulos et al., 2022; Zhao et al., 2024), while the ACTNOW trial showed that gains were not uniform across all motor outcomes, including balance (Haugland et al., 2024). Together, this literature supports assessing flexibility, agility, and balance separately rather than treating gross motor development as a single, uniform outcome.

Related Indonesian research discusses jumping games and other movement-based opportunities for young children (Musa'adah et al., 2023). Studies of dramatic play, cooperative traditional games, and child-friendly settings highlight the broader learning environment (Komariyah et al., 2023; Pratiwi & Widiyono, 2023; Rahmawati et al., 2023). Lesson-planning

research also emphasizes alignment between learning activities and observable indicators (Pratiwi & Utsman, 2022). These perspectives inform classroom practice while addressing outcomes that are not necessarily equivalent to the three ratings examined in this study.

Initial classroom observations at TK PKK Karawana indicated difficulty with bending or turning, changing direction, maintaining positions, and responding to teacher demonstrations during daily activities. In the pretest category distribution, 9 of 15 children (60.00%) were below Developed as Expected for flexibility, 11 (73.33%) for agility, and 13 (86.67%) for balance. These counts represent overlapping ratings of the same group, not separate sets of children. The patterns offered a local rationale for examining movement-and-song activities in the classroom.

This study aimed to describe changes between pretest and posttest in the class-level distributions of flexibility, agility, and balance ratings following movement-and-song activities and to identify domains requiring further support. Changes in coded category means and a combined descriptive score were also summarized. The results are interpreted as observed classroom patterns because the study had no comparison group.

METHODS

Design, Setting, and Participants

A quantitative pre-experimental one-group pretest-posttest design (O1-X-O2) was used at TK PKK Karawana in Dolo District, Sigi Regency, Central Sulawesi, during April-May 2026. Fifteen Group B children contributed to the reported classroom observation distributions. The pretest (O1) assessed flexibility, agility, and balance before movement-and-song activities (X), and the posttest (O2) used the same development-category framework afterward. There was no comparison class or random allocation.

The planning-stage description identified 19 children enrolled in Group B, while the observation tables used for analysis contained 15 children at each assessment. The available records did not specify how these 15 children were selected or account for the difference in group size. Separate age and sex characteristics of the analyzed subset were also not reported. Accordingly, the findings concern the 15 children represented in the observations and have limited generalizability; no prospective sample-size justification was documented (Lakens, 2022).

Intervention Procedure

Movement-and-song activities were scheduled on Wednesdays and Fridays during April-May 2026 within the school's 08:00-10:00 activity block. This block included opening activities and warm-up, demonstration and guided movement practice, a break, and closing activities or cool-down. The teacher introduced movement cues, demonstrated the actions, encouraged imitation, and provided assistance during repeated attempts. The two-hour timetable was not a continuous exercise exposure; active-practice minutes, completed session counts, and attendance were not available in the summarized activity records.

The activity content included four main movements for each song-linked task. With "Pelangi-Pelangi," children bent, swung their arms, stretched, and turned. With "Aram Sam-Sam," they moved, changed position or direction, coordinated hands and body, and responded to cues. With "Lampu Merah, Lampu Hijau," they moved, stopped, maintained a body position, and resumed movement. These tasks represented the classroom focus for flexibility, agility, and

balance, respectively. Appendix A summarizes their movement elements without implying a standardized choreography or a fixed sequence for every session.

Measures and Score Construction

Gross motor development was rated with a classroom observation sheet covering flexibility, agility, and balance. Each domain received one rating using four ordered categories: Not Yet Developed (Belum Berkembang, BB = 1), Beginning to Develop (Mulai Berkembang, MB = 2), Developed as Expected (Berkembang Sesuai Harapan, BSH = 3), and Very Well Developed (Berkembang Sangat Baik, BSB = 4). The possible sum of the three category codes for one child ranged from 3 to 12. These codes are operational classroom classifications and are not calibrated measures of joint range, movement speed, or balance duration.

The descriptors, presented in Appendix A, covered performance of the song-linked movements and the degree of teacher guidance. The higher categories also included cheerfulness and enthusiasm, so a child's motor execution and affective participation contributed to the same rating. Evidence of expert content validation, pilot testing, assessor training, and inter-rater reliability assessment was not reported. The outcomes are therefore treated as ordinal classroom observation ratings rather than independently validated measurements of motor capacity.

Pretest and posttest observations provided the quantitative information. The researcher carried out classroom observations, and an interview with Nursitun, the Group B class teacher, contributed contextual impressions of the activities. The interview was not treated as a separate qualitative outcome because it was not accompanied by a documented transcription and coding procedure. Assessor independence and standardization of assessment conditions across the two occasions were not established.

School Authorization and Ethical Reporting

The headteacher and class teacher authorized classroom research after receipt of a university research permission letter. Approval or exemption by a research ethics committee, informed permission from parents or guardians, and child assent were not documented. School-level authorization does not establish that these additional procedures took place.

Statistical Analysis

Frequencies and percentages were calculated for the four developmental categories in each domain at pretest and posttest, using 15 children as the denominator. The coded mean and sample standard deviation for each domain were calculated from the frequencies with BB = 1, MB = 2, BSH = 3, and BSB = 4. Mean changes were calculated as posttest minus pretest before rounding. These class-level summaries describe differences in marginal distributions and do not identify individual transitions.

The combined descriptive mean at each assessment was reconstructed by weighting the four category codes by their frequencies, summing coded points across the three domains, and dividing by the 15 observations. This yielded 92 pretest points (mean 6.13) and 156 posttest points (mean 10.40); the difference between the occasion means was +4.27 coded points. Analyses were restricted to descriptive comparisons because the domain-specific marginal summaries do not retain each child's linked pretest-posttest ratings or the variability of individual differences needed for an independently reproducible paired test.

Because the four development categories are ordinal, their numerical codes were used only as transparent descriptive summaries. In addition, the assessment descriptors included both

motor performance and participation. Differences in coded means should not be interpreted as changes measured on an interval-scaled physical-performance instrument.

RESULTS AND DISCUSSION

Implementation of Movement and Song Activities

Classroom implementation included warm-up, introduction of song-linked actions, teacher demonstration, guided imitation, repeated practice, a break, and closing reflection or cool-down. The flexibility tasks involved bending, arm swinging, stretching, and turning; the agility tasks involved changes in movement or direction and responses to cues; and the balance tasks involved moving, stopping, maintaining a position, and resuming. Teacher cues and assistance formed part of the regular classroom activities, but individual exposure and active-practice time were not quantified.

At the beginning of the study period, some children required support when following directional instructions or holding a position. Later classroom observations described more confident participation, and the class teacher perceived improvement in the group. These accounts provide context rather than an independent measure of motor development. Related studies also describe the practical use of movement-and-song activities in early-childhood settings (Rohimah & Prianti, 2024; Togatorop & Lestari, 2022); character development is a distinct outcome (Taib et al., 2022).

Changes in Gross Motor Skills

Table 1 shows the pretest and posttest distribution of the four developmental categories in each domain. At pretest, flexibility had 2 BB (13.33%), 7 MB (46.67%), and 6 BSH (40.00%); agility had 5 BB (33.33%), 6 MB (40.00%), and 4 BSH (26.67%); and balance had 3 BB (20.00%), 10 MB (66.67%), and 2 BSH (13.33%). None of the 15 children was rated BSB in any domain at pretest. At posttest, flexibility and agility each had 7 BSH (46.67%) and 8 BSB (53.33%), whereas balance had 3 MB (20.00%), 4 BSH (26.67%), and 8 BSB (53.33%). No posttest rating was BB.

Table 1. Pretest and Posttest Developmental Categories by Domain (n = 15)

Category	Flexibility Pretest	Flexibility Posttest	Agility Pretest	Agility Posttest	Balance Pretest	Balance Posttest
BSB	0 (0.00)	8 (53.33)	0 (0.00)	8 (53.33)	0 (0.00)	8 (53.33)
BSH	6 (40.00)	7 (46.67)	4 (26.67)	7 (46.67)	2 (13.33)	4 (26.67)
MB	7 (46.67)	0 (0.00)	6 (40.00)	0 (0.00)	10 (66.67)	3 (20.00)
BB	2 (13.33)	0 (0.00)	5 (33.33)	0 (0.00)	3 (20.00)	0 (0.00)
Total	15 (100.00)	15 (100.00)	15 (100.00)	15 (100.00)	15 (100.00)	15 (100.00)

Values are n (%). BB = Not Yet Developed; MB = Beginning to Develop; BSH = Developed as Expected; BSB = Very Well Developed. Each column concerns ratings in the same class of 15 children; percentages are rounded to two decimal places.

The proportion rated below BSH declined from 60.00% to 0.00% in flexibility and from 73.33% to 0.00% in agility. For balance, it declined from 86.67% to 20.00%, leaving three children in MB at posttest. Eight children were rated BSB in each domain at posttest, but the

distribution of the remaining ratings differed. Because the data are summarized by domain and occasion, the category histories of individual children cannot be inferred.

Descriptive Domain Scores

Domain means computed from Table 1 increased from 2.27 (SD = 0.70) to 3.53 (SD = 0.52) for flexibility, from 1.93 (SD = 0.80) to 3.53 (SD = 0.52) for agility, and from 1.93 (SD = 0.59) to 3.33 (SD = 0.82) for balance. The corresponding descriptive changes were +1.27, +1.60, and +1.40 coded points. Agility showed the largest difference between occasion means, while balance showed the greatest spread at posttest. These contrasts do not establish differences in the efficacy of the three songs.

Table 2. Descriptive Domain Scores Calculated from Category Frequencies

Domain	Pretest *M* (*SD*)	Posttest *M* (*SD*)	Mean change Post-pre	Observed codes Pre/post
Flexibility	2.27 (0.70)	3.53 (0.52)	1.27	1-3 / 3-4
Agility	1.93 (0.80)	3.53 (0.52)	1.60	1-3 / 3-4
Balance	1.93 (0.59)	3.33 (0.82)	1.40	1-3 / 2-4

Codes: BB = 1, MB = 2, BSH = 3, BSB = 4. SD is the sample standard deviation reconstructed from each domain's category frequencies. Differences were calculated before rounding; they are not paired-domain significance tests.

Combined Descriptive Score

Frequency-weighted domain totals were 92 points at pretest (flexibility 34, agility 29, balance 29) and 156 at posttest (53, 53, and 50, respectively). With 15 children, the combined occasion means were 6.13 and 10.40, giving a descriptive difference of +4.27 coded points (Table 3). These group summaries do not establish the change for any individual child.

Table 3. Descriptive Combined-Score Summaries Reconstructed form Table 1

Statistic	Value
Number of children at each assessment	15
Theoretical combined score range per child	3-12
Pretest points: flexibility/agility/balance	34 / 29 / 29
Pretest total coded points	92
Pretest combined mean	6.13
Posttest points: flexibility/agility/balance	53 / 53 / 50
Posttest total coded points	156
Posttest combined mean	10.40
Difference in total coded points (post-pre)	+64
Difference in occasion means (post-pre)	+4.27

Discussion

The clearest pattern was a shift toward higher observed development categories across all three domains, with a smaller residual subgroup of children rated MB in balance. The class-level trends are compatible with learning to perform the practiced movements, but a one-group design cannot distinguish this possibility from development over time, familiarity with the

tasks, or other activities. Domain-specific interpretation is warranted because the tasks and posttest category profiles were not identical.

Flexibility

Flexibility ratings shifted from 2 BB, 7 MB, and 6 BSH at pretest to 7 BSH and 8 BSB at posttest; the coded mean increased by 1.27 points. Bending, swinging, stretching, and turning during "Pelangi-Pelangi" offered opportunities to practice these actions. Indonesian studies describe similar song-linked movement approaches (Lanapu & Kristsuana, 2025; Maya Tahtani & Sunaryo, 2025). The classroom rubric, however, assessed completion of observable actions rather than direct physiological range of motion.

Flexibility had the highest pretest mean and reached 53.33% BSB at posttest, suggesting that the four-level rating system may have limited room to distinguish further improvement. Repetition and teacher assistance may help task familiarity, but the data cannot distinguish these influences from changes in underlying physical capacity. Research on rhythmic abilities addresses related movement learning while measuring outcomes different from flexibility (Laure & Habe, 2024).

Agility

Agility ratings moved from 5 BB, 6 MB, and 4 BSH at pretest to 7 BSH and 8 BSB at posttest. Its coded mean increased by 1.60 points, the largest descriptive difference among the domains. "Aram Sam-Sam" required changes of direction, locomotor responses, hand-body coordination, and responses to cues. Teacher modeling and repeated movement may support performance of these tasks, but response speed was not directly measured. Related Indonesian research has reported favorable findings for rhythmic gymnastics and movement videos (Lismayani, 2023; Mayar et al., 2022).

Controlled studies of group-play activity, coordination exercises, and rhythmic physical activity have reported task-specific motor outcomes (Bai et al., 2022; Guo et al., 2024; Şendil et al., 2024; Zhao et al., 2024). Some interventions improve selected outcomes without consistent gains across all measures (Başarır et al., 2025). These findings support matching activity demands to the observed task, but they do not validate the current agility scale or permit direct comparisons of effect sizes.

Balance

Balance began with the highest proportion below BSH: 3 BB, 10 MB, and 2 BSH. At posttest, 3 children remained MB, 4 were BSH, and 8 were BSB. The coded mean increased by 1.40 points, but it remained the lowest posttest mean and showed the largest posttest standard deviation (0.82). During "Lampu Merah, Lampu Hijau," children were asked to move, stop, hold a position, and resume on cue. These activities involve stabilization as well as attention; the rubric did not distinguish static from dynamic balance or measure how long positions were maintained.

Action-song training has produced benefits for some balance tests but not others (Chatzopoulos et al., 2022). Other preschool studies have evaluated coordination programmes, Pilates-ball exercises, and short-term balance activities using different measures (Esen et al.,

2023; Obuz & Güçhan Topcu, 2022; Yanovich & Bar-Shalom, 2022). The ACTNOW trial likewise reported outcome-specific findings (Haugland et al., 2024). Thus, the higher ratings in the present study concern the observed classroom tasks and cannot be generalized to all forms of postural control.

Other movement-based activities available in Indonesian early-childhood education include jumping play, footprint-and-handprint mats, rope games, and Kalego (Fitria & Chikmah, 2024; Khaeriyah & Fitrianingtyas, 2026; Lestari et al., 2025; Musa'adah et al., 2023; Saleh et al., 2024). Their relevance is the variety of motor challenges that teachers may use to support children with different needs; the present study does not compare these approaches.

Educational Implications

The observed ratings are consistent with opportunities for repeated, teacher-supported performance of identifiable movement tasks. Rhythm and repetition may structure practice, although their separate contributions were not tested. Evidence concerning rhythm, self-regulation, and school readiness addresses related but distinct outcomes (Bentley et al., 2023; Frey et al., 2022; Williams et al., 2023). Classroom planning should therefore specify the target movement and score its execution rather than infer general motor development from participation alone.

Teachers may use separate checklists for bending, swinging, stretching, turning, changing direction, responding to movement cues, and stopping or holding a position. For children who continue to need balance support, graduated tasks can include slower stop cues, shorter movement distances, stable standing positions, and brief supported holds before more complex turns. Motor accuracy should be recorded independently from enjoyment or enthusiasm. Such adaptations are practical options for local assessment, not interventions whose effectiveness was established by this study (Komariyah et al., 2023; Pratiwi & Widiyono, 2023; Rahmawati et al., 2023; Skene et al., 2022; Tukly et al., 2025).

Study Limitations

Interpretation is constrained by a one-group design without a comparison class. Maturation, regular play and activities outside school, familiarity with the observed tasks, regression to the mean, and observer expectations are plausible alternative explanations. The sample was small, from a single school, and had incomplete participant-flow reporting. Actual practice duration, attendance, and fidelity across sessions were not quantified, and there was no later follow-up to examine persistence of the observed category distributions.

Measurement quality is a major limitation. The four-category instrument lacked documented expert validation, pilot testing, assessor training, calibration, and inter-rater reliability. The researcher also conducted observations without documented independent or blinded ratings, increasing the possibility of observer bias. Furthermore, BSH and BSB descriptors mix performance accuracy with being cheerful or enthusiastic. Higher ratings may therefore reflect engagement or rater impressions as well as movement performance. No separate quantitative assessment of joint range, response speed, or postural stability was available to establish motor-specific change.

The reported outcomes were summarized as marginal frequencies by domain and assessment. Consequently, individual category transitions, paired-score variability, and

sensitivity analyses could not be determined, and all numerical comparisons are descriptive. The reporting of ethical procedures was also incomplete, including formal ethics approval or exemption, parental permission, and child assent. Future investigations should combine prospectively documented recruitment and attendance with a comparison group, trained independent assessors, validated motor-specific measures, and follow-up (Bernabé-Villodre et al., 2024; Lakens, 2022).

CONCLUSION

Following the classroom movement-and-song activities, the 15 Group B children showed higher gross motor development ratings across flexibility, agility, and balance. All were rated at least BSH for flexibility and agility at posttest, whereas three (20.00%) remained MB for balance. Descriptive domain mean differences were +1.27, +1.60, and +1.40 coded points, respectively; the combined mean reconstructed from category frequencies increased from 6.13 to 10.40 (+4.27 points). These findings describe changes in classroom observation categories and do not demonstrate that the activities caused motor-skill improvement. More reliable, motor-specific assessment and a controlled design are needed to determine effectiveness. Balance practice can be adapted for children who still require assistance.

REFERENCES

Bai, J., Huang, H., & Ouyang, H. (2022). Effects of group-play moderate to vigorous intensity physical activity intervention on executive function and motor skills in 4- to 5-year-old preschoolers: A pilot cluster randomized controlled trial. Frontiers in Psychology, 13, 847785. https://doi.org/10.3389/fpsyg.2022.847785

Başarır, B., Canlı, U., Şendil, A. M., Alexe, C. I., Tomozei, R. A., Alexe, D. I., & Burchel, L. O. (2025). Effects of coordination-based training on preschool children's physical fitness, motor competence and inhibition control. BMC Pediatrics, 25, 539. https://doi.org/10.1186/s12887-025-05897-x

Bentley, L. A., Eager, R., Savage, S., Nielson, C., White, S. L. J., & Williams, K. E. (2023). A translational application of music for preschool cognitive development: RCT evidence for improved executive function, self-regulation, and school readiness. Developmental Science, 26(5), e13358. https://doi.org/10.1111/desc.13358

Bernabé-Villodre, M. M., Martínez-Bello, V. E., Vega-Perona, H., Díaz-Barahona, J., Cabrera García-Ochoa, Y., Molines-Borrás, S., Gértrudix-Barrio, F., Montoya-Rubio, J. C., Fernández-Vilar, M. Á., Azorín-Delegido, J. M., Filenko, N., Martínez-Rojas, Á., & Martínez-Bello, D. A. (2024). Effectiveness of a movement and music programme on activity, sedentary, and sleep behaviours and motor and musical skills in young children: Protocol for the MoviMusi cluster randomised controlled trial. Journal of Activity, Sedentary and Sleep Behaviors, 3, 28. https://doi.org/10.1186/s44167-024-00065-5

Chatzopoulos, D., Varsamis, P., Papadopoulos, P., Giannakos, A., Lykesas, G., & Papadopoulou, S. D. (2022). Effects of balance training using action songs on postural control and muscle strength in preschool children. International Electronic Journal of Elementary Education, 15(2), 161-170. https://doi.org/10.26822/iejee.2023.287

Chen, D., Zhao, G., Fu, J., Shun, S., Su, L., He, Z., Chen, R., Jiang, T., Hu, X., Li, Y., & Shen, F. (2024). Effects of structured and unstructured interventions on fundamental motor skills

in preschool children: A meta-analysis. Frontiers in Public Health, 12, 1345566. https://doi.org/10.3389/fpubh.2024.1345566

Dianti, E., & Nursafitri, L. (2024). Mengembangkan motorik kasar pada anak usia dini (PAUD) melalui gerak dan lagu. PERNIK Jurnal PAUD, 7(1), 52-61. https://doi.org/10.31851/pernik.v7i1.15897

Esen, H. T., Güçlüover, A., Kurnaz, M., & Altinkök, M. (2023). The impact of coordination-based movement education model on balance development of 5-year-old children. Frontiers in Psychology, 13, 1045155. https://doi.org/10.3389/fpsyg.2022.1045155

Fitria, F., & Chikmah, A. (2024). Pengembangan kemampuan motorik kasar berbasis permainan tradisional lompat tali pada usia 4-5 tahun. Journal Ashil: Jurnal Pendidikan Anak Usia Dini, 4(1), 46-55. https://doi.org/10.33367/piaud.v4i1.5078

Frey, A., Lessard, A., Carchon, I., Provasi, J., & Pulido, L. (2022). Rhythmic training, literacy, and graphomotor skills in kindergarteners. Frontiers in Psychology, 13, 959534. https://doi.org/10.3389/fpsyg.2022.959534

Guo, X., Li, C., Zhang, Z., Silva, A. F., & Clemente, F. M. (2024). Can motor competence be influenced by the type of training interventions preschool children are exposed to? A randomized experimental study comparing sports games and psychomotricity activities. Frontiers in Psychology, 15, 1476297. https://doi.org/10.3389/fpsyg.2024.1476297

Haugland, E. S., Nilsen, A. K. O., Vabø, K. B., Pesce, C., Bartholomew, J., Okely, A. D., Tjomsland, H. E., Aadland, K. N., & Aadland, E. (2024). Effects of a staff-led multicomponent physical activity intervention on preschooler's fundamental motor skills and physical fitness: The ACTNOW cluster-randomized controlled trial. International Journal of Behavioral Nutrition and Physical Activity, 21, 69. https://doi.org/10.1186/s12966-024-01616-4

Kevin Julian, A., Fitriani, Y., & Nuroniah, P. (2024). Peran aktivitas gerak dan lagu sebagai strategi pengembangan kemampuan motorik kasar anak usia 5-6 tahun. Murhum: Jurnal Pendidikan Anak Usia Dini, 5(2), 587-602. https://doi.org/10.37985/murhum.v5i2.925

Khaeriyah, N., & Fitrianingtyas, A. (2026). Meningkatkan kemampuan motorik kasar anak usia 4-5 tahun melalui permainan lompat tali. Early Childhood Education and Development Journal, 8(1), 1-11. https://jurnal.uns.ac.id/ecedj/article/view/116016

Komariyah, S., Suzana, & Budiani, N. (2023). Menanamkan kerjasama pada anak melalui permainan Rangkuk Alu di RA Azahra Cirebon. Hadlonah: Jurnal Pendidikan dan Pengasuhan Anak, 4(2), 76-81. https://jurnal.uibbc.ac.id/index.php/hadlonah/article/view/1344

Lakens, D. (2022). Sample size justification. Collabra: Psychology, 8(1), 33267. https://doi.org/10.1525/collabra.33267

Lanapu, G. D., & Kristsuana, L. N. (2025). Penerapan metode gerak dan lagu sebagai stimulasi motorik kasar pada anak usia dini 4-5 tahun. Aletheia Christian Educators Journal, 6(1), 19-26. https://doi.org/10.9744/aletheia.6.1.19-26

Laure, M., & Habe, K. (2024). Stimulating the development of rhythmic abilities in preschool children in Montessori kindergartens with music-movement activities: A quasi-experimental study. Early Childhood Education Journal, 52, 563-574. https://doi.org/10.1007/s10643-023-01459-x

Lestari, S., Elnawati, & Hurri, I. (2025). Implementasi permainan playmate karpet edukatif jejak kaki dan tangan dalam meningkatkan motorik kasar anak usia dini 5-6 tahun. Alahyan Jurnal Pengabdian Masyarakat Multidisiplin, 3(1), 142-147.

https://doi.org/10.61492/ecos-preneurs.v3i1.278

Lismayani, A. (2023). Pengaruh kegiatan senam irama terhadap kemampuan motorik kasar anak usia dini. ECEJ: Early Childhood Education Journal, 1(1), 1-5. https://doi.org/10.62330/ecej.v1i1.9

Liu, B., Yan, Y., Jia, J., & Liu, Y. (2025). Can active play replace skill-oriented physical education in enhancing fundamental movement skills among preschool children? A systematic review and meta-analysis. BMC Public Health, 25, 1399. https://doi.org/10.1186/s12889-025-22398-9

Maya Tahtani, D., & Sunaryo, I. (2025). Meningkatkan motorik kasar dengan media musik melalui gerak dan lagu Kupu Kuwi untuk anak PAUD. Murhum: Jurnal Pendidikan Anak Usia Dini, 6(1), 108-118. https://doi.org/10.37985/murhum.v6i1.1045

Mayar, F., Sakti, R., Yanti, L., Erlina, B., Osriyenti, & Holiza, W. (2022). Pengaruh video pembelajaran gerak dan lagu untuk meningkatkan fisik motorik pada anak usia dini. Jurnal Obsesi: Jurnal Pendidikan Anak Usia Dini, 6(4), 2619-2625. https://doi.org/10.31004/obsesi.v6i4.2081

Musa'adah, A., Amini, U., & Taufiqurrahman. (2023). Stimulasi perkembangan motorik kasar anak melalui ragam main melompat di RA Assalafiyah Cirebon. Hadlonah: Jurnal Pendidikan dan Pengasuhan Anak, 4(2), 49-57. https://jurnal.uibbc.ac.id/index.php/hadlonah/article/view/1334

Nurasyiah, R., & Atikah, C. (2023). Karakteristik perkembangan anak usia dini. Khazanah Pendidikan, 17(1), 75-81. https://doi.org/10.30595/jkp.v17i1.15397

Obuz, T., & Güçhan Topcu, Z. (2022). The effects of exercises with a Pilates ball on balance, reaction time and dual-task performance of kindergarten children. Journal of Comparative Effectiveness Research, 11(8), 583-593. https://doi.org/10.2217/cer-2021-0293

Pratiwi, D., & Widiyono, A. (2023). Penerapan model dramatic play dalam menumbuhkan imajinasi anak usia dini. Hadlonah: Jurnal Pendidikan dan Pengasuhan Anak, 4(1), 25-35. https://jurnal.uibbc.ac.id/index.php/hadlonah/article/view/718

Pratiwi, E. S., & Utsman, A. F. (2022). Perencanaan pembelajaran dalam pendidikan anak usia dini. Abata: Jurnal Pendidikan Islam Anak Usia Dini, 2(2), 232-240. https://doi.org/10.32665/abata.v2i2.881

Rahmawati, R., Fajriah, H., & Hayati, Z. (2023). Model sekolah PAUD ramah anak berbasis Islam di Kecamatan Singkohor Aceh Singkil. Hadlonah: Jurnal Pendidikan dan Pengasuhan Anak, 4(2), 17-31. https://jurnal.uibbc.ac.id/index.php/hadlonah/article/view/1330

Rohimah, S., & Prianti, N. (2024). Penerapan gerak dan lagu dalam mengembangkan kemampuan motorik kasar anak. JIIP - Jurnal Ilmiah Ilmu Pendidikan, 7(12), 13961-13965. https://doi.org/10.54371/jiip.v7i12.6439

Saleh, R., Susanti, S. M., Muna, S., & Hertuni, F. (2024). Analisis permainan Kalego untuk mengasah kemampuan motorik kasar anak usia dini. Murhum: Jurnal Pendidikan Anak Usia Dini, 5(2), 1284-1293. https://doi.org/10.37985/murhum.v5i2.993

Skene, K., O'Farrelly, C. M., Byrne, E. M., Kirby, N., Stevens, E. C., & Ramchandani, P. G. (2022). Can guidance during play enhance children's learning and development in educational contexts? A systematic review and meta-analysis. Child Development, 93(4), 1162-1180. https://doi.org/10.1111/cdev.13730

Şendil, A. M., Canlı, U., Bin Sheeha, B., Alkhamees, N. H., Batrakoulis, A., & Al-Mhanna, S.

B. (2024). The effects of structured coordinative exercise protocol on physical fitness, motor competence and inhibitory control in preschool children. Scientific Reports, 14, 28462. https://doi.org/10.1038/s41598-024-79811-3

Taib, B., Samad, R., Oktaviani, W., & Irham, M. (2022). Implementasi seni gerak dan lagu dalam membentuk karakter anak usia 4-5 tahun di PAUD Kemala Bhayangkari. Jurnal Ilmiah Cahaya Paud, 4(2), 1-14. https://doi.org/10.33387/cahayapd.v4i2.5337

Togatorop, E. C. D., & Lestari, R. H. (2022). Implementasi gerak dan lagu dalam meningkatkan perkembangan motorik kasar anak usia dini melalui pembelajaran daring. CERIA (Cerdas Energik Responsif Inovatif Adaptif), 5(4). https://doi.org/10.22460/ceria.v5i4.11540

Tukly, W. V., Nilapancuran, M. M., Matital, K. A., Kothel, S., & Lesbassa, L. (2025). Membangun fondasi pendidikan anak usia dini melalui pendekatan pembelajaran yang menyenangkan. CARONG: Jurnal Pendidikan, Sosial dan Humaniora, 2(2), 754-764. https://doi.org/10.62710/vp1c3790

Williams, K. E., Bentley, L. A., Savage, S., Eager, R., & Nielson, C. (2023). Rhythm and movement delivered by teachers supports self-regulation skills of preschool-aged children in disadvantaged communities: A clustered RCT. Early Childhood Research Quarterly, 65, 115-128. https://doi.org/10.1016/j.ecresq.2023.05.008

Yanovich, E., & Bar-Shalom, S. (2022). Static and dynamic balance indices among kindergarten children: A short-term intervention program during COVID-19 lockdowns. Children, 9(7), 939. https://doi.org/10.3390/children9070939

Zhao, H., Deng, Y., Song, G., Zhu, H., Sun, L., Li, H., Yan, Y., & Liu, C. (2024). Effects of 8 weeks of rhythmic physical activity on gross motor movements in 4-5-year-olds: A randomized controlled trial. Journal of Exercise Science & Fitness, 22(4), 456-462. https://doi.org/10.1016/j.jesf.2024.10.001