

**The Effect of Throwing and Catching Exercises on Basketball Playing Ability of Grade 3 Students at SDI Unggulan BTN Pemda**

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**ABSTRACT**

Background: Throwing and catching skills form the primary foundation of basketball that must be developed from an early age. For Grade 3 elementary students, hand-eye coordination, fine motor control, and ball-handling confidence are essential prerequisites in physical education learning. However, the lack of structured training programs targeting these fundamental skills hinders the improvement of basketball abilities at the elementary level. Objectives: This study aimed to analyze the effect of an 8-week structured throwing and catching training program on basketball playing ability among Grade 3 students at SDI Unggulan BTN Pemda. Methods: A pre-experimental one-group pre-test post-test design was applied to 30 Grade 3 students (15 male, 15 female) selected through total sampling. Instruments included chest pass accuracy test, bounce pass test, overhead pass test, zigzag dribbling, lay-up test, and a modified 3 vs 3 game assessment. The intervention was conducted 3 sessions per week for 8 weeks. Results: Significant improvements were found across all basketball playing ability variables ( $p < 0.05$ ). The largest gains were in chest pass accuracy (+48.6%), followed by bounce pass (+41.2%) and 3 vs 3 game score (+38.4%). Significant improvements were also noted in zigzag dribbling (-24.8%), overhead pass (+36.7%), and lay-up (+33.1%). Conclusions: A systematic and structured throwing and catching training program significantly improved basketball playing ability among Grade 3 students at SDI Unggulan BTN Pemda, proving effective as a pedagogical approach in elementary school physical education.

**Keywords:** Throwing and Catching; Basketball; Elementary School; Physical Education; Motor Skills.

**INTRODUCTION**

Physical education at the elementary school level has a very strategic role in forming the foundation of basic movement, physical fitness, and positive character of children from an early age (Arga & Fitri, 2025). One of the sports that began to be introduced at the 3rd grade level of elementary school is basketball in the form of modifications that are adjusted to the stage of motor development of children aged 8–9 years (Bakhtiar, 2013; Sortwell et al., 2022). The game of basketball, although in a simplified format, demands the mastery of complex basic manipulative movement skills especially passing and catching which are the foundation of all advanced technical skills in the game of basketball (Chen et al., 2021; Satria et al., 2024).

Throwing skills are not just physical abilities, but are the integration of several domains of child development: (1) the motor domains of hand-eye coordination, ballistic control, and timing; (2) the cognitive domain of decision-making when and how to throw in game situations; and (3) the affective domain of confidence in cooperating with friends and tolerance for mistakes. Good throwing and catching skills have been shown to be strong predictors of active participation

in games, confidence levels, and enjoyment of exercise in elementary school-aged children (Alves Guimarães et al., 2024; Johnson et al., 2025; Park et al., 2022).

SDI Unggulan BTN Pemda is a leading Islamic elementary school located in the BTN Pemda residential area and has relatively complete sports facilities compared to elementary schools in general in the region. However, preliminary observations made by researchers found that the throwing ability of 3rd graders is still relatively low: most students are not able to make chest passes with adequate accuracy at a distance of 3 meters, have difficulty catching balls that come at medium speed, and show hand-eye coordination that has not developed well. This condition hindered the smooth learning of the basketball game which began to be introduced in that semester.

Low throwing skills in elementary school students are generally due to several factors: lack of practice time focused on these basic skills outside of lesson hours, learning methods that do not use a fun and student-centered approach, and lack of equipment that is sized according to the child's body dimensions (a size 5 ball is often too big for the hands of a 3rd grader). Therefore, a specially designed, progressive, and fun throwing training program for children aged 8–9 years is needed (Johnson et al., 2019; Saputra et al., 2021).

Various studies have shown the effectiveness of structured basic movement skills training programs in improving the abilities of elementary school-age children. However, research that specifically examines the effect of the throwing practice program on the basketball ability of elementary school students, especially in the context of superior schools with superior physical education programs, is still very limited in Indonesia. This gap is the main motivation for this research.

This study aims to: (1) analyze the effect of the 8-week structured throwing training program on the basketball playing ability of grade 3 students of SDI Unggulan BTN Pemda; (2) identify the aspects of skills that have experienced the most significant improvement; and (3) provide pedagogical recommendations for physical education teachers and school principals regarding the importance of structured basic training programs in the elementary school physical education curriculum.

## **METHODS**

### **Research Design**

This study uses a pre-experimental design with a one-group pre-test post-test design. This design was chosen because the entire target population (grade 3 students of SDI Unggulan BTN Pemda) was included in the intervention without a control group, given the ethical considerations that all students are entitled to the same learning program, as well as the limited population size. The free variable in this study was the catch throw training program, while the bound variable was basketball playing ability measured through six standardized test indicators and one modified game assessment.

### **Population and Sample**

The population as well as the research sample is all 3rd grade students of SDI Unggulan BTN Pemda, which totals 30 students (15 males, 15 females), selected using the total sampling technique because the population is small and can be fully affordable. The inclusion criteria applied include: (1) being registered as an active student in grade 3 in the 2024/2025 school year; (2) not have a physical limitation or motor impairment that affects the ability to throw and catch; (3) attend at least 80% of the total training sessions (24 sessions out of 24 planned sessions, attendance tolerance is maximum 5 sessions).

### **Sample Development Characteristics**

Grade 3 students of SDI Unggulan BTN Pemda are in the age range of 8–9 years, which is the 'golden age of motor learning' phase. In this phase, the child's nervous system undergoes rapid maturation so that the capacity to learn and consolidate new movement patterns is very high. The cerebral cortex, cerebellum, and basal ganglia are the three main components in motor control are in an intensive myelination process that increases the speed of nerve impulse conduction and

the precision of motion coordination (Gallahue & Ozmun, 2012). This condition makes the basic skills training program at this age have a greater long-term impact than if given at an older age.

#### Throw And Catch Training Program

The training program is carried out for 8 weeks with a frequency of 3 sessions per week (total 24 sessions), each lasting 60 minutes per session consisting of: 10-minute warm-up (dynamic play and stretching), 40-minute core exercise, and 10-minute cool-down (static reflection and stretching). The program is designed in two progressive phases:

Phase 1 Foundation (Weeks 1–4): The entire exercise is focused on mastering the basic technique of throwing catches with a ball that is adjusted in size (size 4 rubber ball or mini volleyball) to make it easier for the child to grip. The material includes: (a) chest pass exercises in pairs of 2–3 meters with emphasis on hand position, wrist strokes, and follow-through; (b) the target bounce pass drill on the floor; (c) overhead pass training; (d) catching balls from various directions and heights; (e) Simple doubles catch throwing game ('hot potato', 'keep away' modifications). Intensity: low-medium; Volume: 3–4 sets × 10–15 reps per drill.

Phase 2 Development and Integration (Weeks 5–8): Exercises are enhanced by adding moving components, longer distances (3–5 meters), and more complex game situations. Materials include: (a) chest pass while moving (give-and-go); (b) bounce pass in pressure situations (passive defender); (c) dribbling exercises combined with chest passes; (d) a simple lay-up preceded by a chest pass from a friend; (e) 3 vs 3 small field modification game. Intensity: medium-high; Volume: 4–5 sets × 10–12 repetitions.

#### Measurement Instruments

Basketball ability was measured through six standardized test instruments that have been modified for elementary-age children, as well as one game assessment:

(1) Chest Pass Accuracy Test: students make 10 chest passes from a distance of 3 meters to the target of a circle with a diameter of 60 cm on the wall, the score is the number of throws that hit the target. Validity = 0.82; reliability = 0.89. (2) Bounce Pass Test: 10 bounce pass throws to the target of the 50×50 cm box on the floor at a distance of 3 meters, the score is the number of throws that hit the target box. (3) Overhead Pass Test: 10 overhead pass throws to the goal of the circle 3 meters away from the overhead position. (4) Dribbling Zigzag Test: students dribble the ball over 5 obstacles (distance between obstacles is 1 meter) round trip, time recorded in seconds. (5) Lay-up Test: 10 lay-up attempts from the right side, score is the number of balls in. (6) 3 vs 3 Modified Game Assessment: each student is observed for 5 minutes of modified games by two trained observers using a 10-item assessment rubric (passing, catching, dribbling, positioning, cooperation) on a scale of 1–4. Inter-rater reliability = 0.91.

#### Data Analysis

Data were analyzed using IBM SPSS Statistics version 27. The normality test used Shapiro-Wilk. Due to the pre-post one-group design, comparisons before and after the intervention used paired samples t-test (normal distribution) or Wilcoxon Signed-Rank test (abnormal). Significance level  $\alpha = 0.05$ . The magnitude of the effect was reported using Cohen's *d*. Additional analysis was conducted to compare the magnitude of the increase between male and female students using independent samples t-test on gain scores (Borbats & Shkolina, 2021).

## RESULTS RESULTS

### Initial Characteristics of Samples

Demographic characteristics and pre-test results of the entire sample. Data shows that the initial condition of the ability to throw, catch and play basketball for grade 3 students of SDI Unggulan BTN Pemda as a whole is in the category of 'lacking' to 'adequate' based on the norms of motor ability of children aged 8–9 years.

### Results of changes in basketball ability after intervention

Table 1 presents a comparison of pre-test and post-test results on all variables of basketball playing ability, along with the amount of changes and statistical test results. All variables showed statistically significant changes after 8 weeks of the throw and catch training program.

**Table 1. Comparison of Pre-test and Post-test Basketball Ability**

Variabel	Pre-test Mean±SD	Post-test Mean±SD	D (%)	p-value (Cohen's d)
Chest Pass Accuracy (dari 10)	3,3±1,2	4,9±1,3	+48,6%	0,001* (1,28)
Bounce Pass (out of 10)	3,1±1,1	4,4±1,2	+41,2%	0,001* (1,12)
Overhead Pass (out of 10)	2,9±1,0	3,9±1,1	+36,7%	0,001* (0,94)
Dribbling Zigzag (seconds)	23,5±2,5	17,7±2,1	-24,8%	0,001* (2,52)
Lay-up (dari 10)	2,6±0,9	3,5±1,0	+33,1%	0,001* (0,94)
Game Score 3 vs 3 (max 40)	17,8±3,0	24,6±3,4	+38,4%	0,001* (2,11)

#### Comparison of Improvements between Male and Female Students

Table 2 presents a comparison of gain scores between male and female students to identify whether there is a difference in response to the exercise program by gender.

**Table 2. Male vs Female Gain Score Comparison**

Variabel	Male Δ Mean±SD	Female Δ Mean±SD	p-value	Ket.
Chest Pass Accuracy	+1,8±0,6	+1,4±0,5	0,068	No sig.
Bounce Pass	+1,4±0,5	+1,2±0,4	0,231	No sig.
Overhead Pass	+1,1±0,4	+0,9±0,4	0,184	No sig.
Dribbling Zigzag (seconds)	-6,2±1,8	-5,4±1,6	0,187	No sig.
Lay-up	+1,0±0,4	+0,8±0,3	0,112	No sig.
Game Score 3 vs 3	+7,4±2,1	+6,2±1,9	0,094	No sig.

#### Categorization of Pre-test and Post-test Basketball Playing Ability

Table 3 presents the distribution of students by basketball ability category in the pre-test and post-test, showing a clear positive shift from the 'less' to 'adequate' and 'good' categories.

**Table 3. Distribution of Basketball Playing Ability Categories Pre-test vs Post-test**

Category	Pre-test n (%)	Post-test n (%)	Changes	Score Range (max 40)	Interpretasi
Very Less	5 (16,7%)	0 (0%)	-5	< 10	Need intensive guidance
Less	14 (46,7%)	4 (13,3%)	-10	10–19	Need basic training
Enough	9 (30,0%)	16 (53,3%)	+7	20–29	Adequate capabilities
Good	2 (6,7%)	8 (26,7%)	+6	30–36	Above average
Excellent	0 (0%)	2 (6,7%)	+2	37–40	Competition ready

Keterangan: Kategorisasi berdasarkan adaptasi norma AAHPERD Basketball Skills Test yang disesuaikan untuk anak usia 8–9 tahun

## DISCUSSION

### The Effect of Throwing Catch Drills on Passing Accuracy

The increase in chest pass accuracy of 48.6% (from an average of 3.3 to 4.9 in 10 trials) was the largest improvement among all the variables measured, with Cohen's  $d = 1.28$  (large effect). These results are consistent with motor learning theory which asserts that repetitive ballistic skills such as chest passes will experience rapid improvement in the early stages of learning if given sufficient feedback and an adequate number of repetitions (Geisen & Klatt, 2022, 2022).

The mechanism of increasing chest pass accuracy in children aged 8–9 years mainly occurs through the consolidation of motor programs in the premotor cortex and cerebellum. Each repetition of the drill chest pass provides an opportunity for the nervous system to compare the actual movement results with the expected movement targets, resulting in predictive corrections that get finer and smoother as the number of repetitions increases. This process, known as forward model refinement, is increasingly efficient in children aged 8–9 years due to the intensive process of myelination of the corticospinal tract (Bae et al., 2025; Chiviacowsky et al., 2019; Geisen & Klatt, 2022).

The slightly smaller increase in bounce passes (+41.2%) and overhead passes (+36.7%) compared to chest passes can be explained by the partial transfer of learning from the first and most intensive trained chest pass skills to other types of passing. These three types of passes share the same basic biomechanical elements: wrist strokes, elbow extensions, and timing releases, so chest pass mastery facilitates the learning of bounce passes and overhead passes through basic motion positive transfer mechanisms.

### Influence on Dribbling and Lay-up

The 24.8% increase in zigzag dribbling (time reduced from 23.5 to 17.7 seconds;  $d = 2.52$ , very large effect) is an interesting finding, given that the training program does not directly target dribbling skills as a key component. This increase is likely mediated by: (1) the transfer of motion from ball-catching exercises that improve ball control abilities in general, including dribbling; (2) increased confidence in handling the ball which psychologically reduces motor anxiety when dribbling; and (3) improved manual control and tactile sensitivity of the hands which are fundamental components in both catching and dribbling (Nascimento et al., 2016) (Donath et al., 2015).

The 33.1% increase in lay-ups ( $d = 0.94$ ) is also quite significant considering that lay-ups are more complex skills with a multistep component and higher coordination. This improvement reflects the results of the integration of the throwing and catch practice with the lay-up element introduced in Phase 2 (weeks 5–8), where students practice a lay-up preceded by a chest pass from a partner.

### 3 vs 3 Game Ability Upgrades

The 3 vs 3 game score increase of 38.4% (from 17.8 to 24.6 from a maximum score of 40;  $d = 2.11$ , very large effect) is the most comprehensive indicator of program success, as it captures the transfer of skills to real-life game situations involving elements of decision-making, defensive pressure, and teamwork. This significant improvement in game assessment confirms that the throwing and catch practice carried out does not only improve isolated skills, but effectively improves the ability to play basketball holistically.

These findings support the principle of specificity of training while demonstrating a meaningful transfer from basic skill training (throwing and catching) to game performance. This is consistent with the ecological dynamics model in sports motor learning which emphasizes the importance of designing exercises that have a high representation of the actual game situation .  
Equality of Adaptation Responses between Men and Women.

The finding that there was no significant difference in gain scores between male and female students on all measured variables ( $p = 0.068–0.231$ ) is an important finding from a pedagogical perspective. These findings indicate that a well-designed throwing training program provides equal benefits for boys and girls at 8–9 years of age, a finding consistent with the

principle that differences in sex-based motor abilities are not biologically significant before puberty (Gallahue & Ozmun, 2012).

This equality of response also supports the importance of gender-inclusive physical education programs in primary schools, where there is no need to differentiate programs based on gender at this age. Trainers and teachers can implement the same program with the belief that the benefits will be felt equally by all students.

The distribution of ability categories presented in Table 4 visually shows a very significant shift: before the intervention, 63.4% of students were in the 'very poor' or 'less' category, while after the intervention, 86.7% of students had reached the 'sufficient' category or higher. No more students are in the 'very poor' category after 8 weeks of the program. This shift in distribution is concrete evidence of the program's impact that is not only statistically visible, but also practically meaningful on the ground.

## CONCLUSIONS AND SUGGESTIONS

### Conclusion

This study produced four main conclusions based on the analysis of pre-test and post-test data on 30 grade 3 students of SDI Unggulan BTN Regional Government.

First, the throwing and catching training program which was carried out in a structured and progressive manner for 8 weeks (3 sessions per week) was statistically and practically proven to significantly improve the basketball playing ability of 3rd grade SDI students of SDI Unggulan BTN Pemda on all variables measured ( $p < 0.001$ ; Cohen's  $d = 0.94-2.52$ ).

Second, the largest improvements occurred in chest pass accuracy (+48.6%), followed by bounce pass (+41.2%), 3 vs 3 game score (+38.4%), overhead pass (+36.7%), lay-up (+33.1%), and zigzag dribbling (+24.8%), which overall reflect a holistic improvement in basketball playing ability, rather than just isolated skills.

Third, the distribution of basketball ability categories experienced a very significant positive shift: the percentage of students in the 'lacking' and 'very poor' categories decreased from 63.4% to 13.3%, while students who achieved the categories of 'adequate', 'good', and 'excellent' increased from 36.7% to 86.7%.

Fourth, there was no significant difference in the amount of improvement between male and female students ( $p > 0.05$ ) across all variables, confirming that the throwing exercise program was equally effective for both sexes and feasible to be applied to mixed classes.

### Suggestions

Based on the findings of this study, the following suggestions are proposed: (1) SDI Superior BTN Pemda physical education teachers are advised to integrate a structured throwing and catch training program into the 3rd grade Learning Implementation Plan (RPP) in a systematic and continuous manner, at least 3 sessions per week with a core duration of 40 minutes; (2) The use of appropriately sized balls (size 4 mini basketball or rubber balls) is highly recommended for grade 3 elementary school, as it has been proven to increase students' confidence and movement efficiency in controlling the ball; (3) Each practice session is recommended to end with a 3 vs 3 modified game for 10–15 minutes to maximize skill transfer from isolated practice to real game situations; (4) School principals are advised to allocate additional physical training time outside of regular physical training hours, especially for basic basketball skills that require sufficient reps for the consolidation of motor programs; (5) Follow-up research is recommended to involve a more robust control and design group (randomized controlled trial) and examine the sustainability of exercise effects in the follow-up period 3 and 6 months after the end of the program.

## REFERENCES

Alves Guimarães, L., De Oliveira Cunha, C., Bizinotto, T., Gomes Campos, K., Leite De Souza, G. H., Martins, C. K., & Formiga, R. (2024). ARTIGO ORIGINAL. *Geriatr Gerontol Aging*, 20(20), 349–358. <https://doi.org/10.6063/motricidade.35599ERRATA>

- Arga, A., & Fitri, R. (2025). Peningkatan Kemampuan Motorik Kasar Melalui Permainan Interaktif Di TK Thalabul Ilmi. *SPORTIVE: Journal Of Physical Education, Sport and Recreation*, 9(6), 273–283.
- Bae, H., Seo, J., Kim, C. E., & Kim, S. J. (2025). A normative principle governing memory transfer in cerebellar motor learning. *Nature Communications*, 16(1). <https://doi.org/10.1038/s41467-025-60511-z>
- Bakhtiar, S. (2013). The implementation of dynamic system theory and the principles of growth in physical education of elementary school. *Asian Social Science*, 9(12 SPL ISSUE), 105–109. <https://doi.org/10.5539/ass.v9n12p105>
- Borbats, N. M., & Shkolina, T. V. (2021). Comparing the test power for the normal distribution of the direct multiple measurements. *Journal of Physics: Conference Series*, 1889(5). <https://doi.org/10.1088/1742-6596/1889/5/052036>
- Chen, J., Wang, X., & Chen, W. (2021). Impact of bilateral coordinated movement on manipulative skill competency in elementary school students. *Children*, 8(6). <https://doi.org/10.3390/children8060517>
- Chiviawosky, S., Harter, N. M., Gonçalves, G. S., & Cardozo, P. L. (2019). Temporal-comparative feedback facilitates golf putting. *Frontiers in Psychology*, 9(JAN). <https://doi.org/10.3389/fpsyg.2018.02691>
- Donath, L., Faude, O., Hagmann, S., Roth, R., & Zahner, L. (2015). Fundamental movement skills in preschoolers: a randomized controlled trial targeting object control proficiency. *Child: Care, Health and Development*, 41(6), 1179–1187. <https://doi.org/https://doi.org/10.1111/cch.12232>
- Gallahue, D. L., Ozmun, J. C., & Goodway, J. D. (2012). *Understanding motor development: Infants, children, adolescents, adults*. McGraw-Hill.
- Geisen, Mai, & Klatt, Stefanie. (2022). Real-time feedback using extended reality: A current overview and further integration into sports. *International Journal of Sports Science & Coaching*, 17(5), 1178–1194. <https://doi.org/10.1177/17479541211051006>
- Johnson, J. L., Jenkins, E., Breault, K., & Uanhoro, J. O. (2025). Intra and Inter Skill Changes in Preschoolers Fundamental Motor Skills. *Journal of Motor Behavior*, 57(3), 299–310. <https://doi.org/10.1080/00222895.2025.2475187>
- Johnson, J. L., Rudisill, M. E., Hastie, P. A., & Sassi, J. (2019). The Influence of Guided Practice on Overhand Throwing Competence in Preschool Children in a Mastery Motivational Climate. *Journal of Motor Learning and Development*, 7(1), 64–83. <https://doi.org/10.1123/jmld.2018-0005>
- Nascimento, L. P., Oliva-Pascual-Vaca, A., Renan-Ordine, R., Riquelme, I., Ricard, F., & Rodriguez-Blanco, C. (2016). Comparative assessment of tactile sensitivity between undergraduate and postgraduate health sciences students. *International Journal of Osteopathic Medicine*, 19, 13–19. <https://doi.org/10.1016/j.ijosm.2015.09.002>
- Park, S. B., Ju, Y., Kwon, H., Youm, H., Kim, M. J., & Chung, J. (2022). Effect of a Cognitive Function and Social Skills-Based Digital Exercise Therapy Using IoT on Motor Coordination in Children with Intellectual and Developmental Disability. *International Journal of Environmental Research and Public Health*, 19(24). <https://doi.org/10.3390/ijerph192416499>
- Saputra, H., Hanif, A. S., Sulaiman, I., & Ningrum, D. T. M. (2021). The effect of traditional games and drill with motor ability on skills (Running, jumping, overhand throw and catching) at elementary school. *International Journal of Human Movement and Sports Sciences*, 9(6), 1097–1103. <https://doi.org/10.13189/saj.2021.090603>
- Satria, M. H., Aliriad, H., Nuzulia, D., Mangngassai, I. A. M., Junaidi, I. A., & Zainuddin, M. (2024). Game-based physical education learning to improve basic manipulative movement skills in primary school children. *Edelweiss Applied Science and Technology*, 8(6), 8117–8125. <https://doi.org/10.55214/25768484.v8i6.3756>
- Sortwell, A., Marinho, D. A., Knijnik, J., & Ferraz, R. (2022). Empowering Primary School Students, Potential Benefits of Resistance Training Movement Activities in Physical Education: Narrative Review. *Kinesiology Review*, 11(3), 197–208. <https://doi.org/10.1123/kr.2021-0021>