Jurnal SPORTIF: Jurnal Penelitian Pembelajaran
Vol. 12 No. 2, August 2026, pp. 408 - 426
https://doi.org/10.29407/js_unpgri.v12i2.28490

Students' Motor Skill Changes Following the Sport Education Model

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Received: 23 February 2026; Revised: 18 April 2026; Accepted: 29 August 2026; Available online: 31 August 2026.

Abstract

Motor skill development is an important component of elementary physical education, requiring structured and developmentally appropriate learning experiences that provide opportunities for active motor practice. This study examined pretest–posttest changes in motor skills among fifth-grade elementary school students following implementation of the Sport Education model. A pre-experimental one-group pretest–posttest design was employed involving 30 eligible fifth-grade students selected through total sampling. Motor skills were assessed using a test measuring coordination, agility, balance, and speed. The instrument underwent content validity evaluation through expert judgment and demonstrated good reliability (Cronbach's α = .87). Data were analyzed using descriptive statistics, a normality test, and a paired-samples t-test at a significance level of .05. The mean motor skill score increased from 67.93 (SD = 7.01) at pretest to 83.26 (SD = 6.78) at posttest. The paired-samples t-test revealed a statistically significant difference between the two measurements, $t(29) = 10.42$, $p < .001$, with a large effect size (Cohen's $d = 1.90$). These findings document positive changes in students' motor skills following the implementation of Sport Education; however, the one-group pretest–posttest design does not permit definitive causal conclusions. The study provides empirical evidence on motor skill changes in elementary physical education and highlights the potential relevance of structured Sport Education experiences for supporting coordination, agility, balance, and speed among fifth-grade students.

Keywords: Sport education, motor skills, elementary physical education, motor learning.

How to Cite: Syafutra, W., & Suhdy, M. (2026). Students' Motor Skill Changes Following the Sport Education Model. Jurnal SPORTIF : Jurnal Penelitian Pembelajaran, 12(2), 408–426. https://doi.org/10.29407/js_unpgri.v12i2.28490

Authors contribution: a – Preparing concepts; b – Formulating methods; c – Conducting research; d – Processing results; e – Interpretation and conclusions; f - Editing the final version.

INTRODUCTION

Physical education plays an important role in supporting the physical, cognitive, affective, and social development of elementary school students (Kasman & Lubis, 2022). At the elementary level, particularly in fifth grade,

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students aged 10–11 years are at an important stage of motor development in which coordination, balance, agility, and speed continue to develop (Candra et al., 2025). Motor skills encompass not only fundamental movements such as running, jumping, throwing, and catching, but also coordination, balance, movement control, and other components involved in physical performance (Fantiro et al., 2025). Adequate motor competence supports students' ability to participate in physical activity and increasingly complex sport activities (Haegele et al., 2024). It is associated with the development of active lifestyles from an early age (Ekantini et al., 2024). Therefore, elementary physical education should provide systematic and developmentally appropriate learning experiences that support students' motor development.

However, motor learning experiences in elementary physical education are not always implemented optimally. Learning practices may emphasize general physical activities without systematically targeting fundamental motor skills and may provide limited opportunities for active practice, movement exploration, and repeated motor experiences. Physical education also continues to rely substantially on teacher-centered approaches in which teachers dominate instruction through explanations and demonstrations while students primarily follow predetermined movements (Miller et al., 2023). Excessive reliance on direct instruction may restrict opportunities for repeated practice, movement exploration, and meaningful motor learning experiences (Dobson, M. J., 2023). Consequently, students may have fewer opportunities to develop motor skills through structured and purposeful movement experiences.

Elementary school students generally benefit from learning experiences that incorporate movement, play, interaction, and developmentally appropriate challenges (Susilo et al., 2024). Structured play, teamwork, and well-designed movement challenges can give students opportunities to participate actively while practicing motor skills (Goodyear, 2024). Therefore, physical education requires instructional approaches that combine clear, structured learning

objectives with active participation and meaningful movement experiences, rather than relying predominantly on teacher-directed activities.

One instructional model relevant to these learning needs is Sport Education (Permatasari et al., 2025). Sport Education provides structured, authentic sport experiences through a seasonal learning format. Its main characteristics include permanent teams, role assignments, formal competition, performance recording, and end-of-season activities (Didik Purwanto, 2025). These characteristics provide opportunities for active participation, repeated practice, collaboration, and contextualized game experiences. In elementary physical education, Sport Education can be adapted to students' developmental levels through simplified rules, appropriate roles, and inclusive learning activities (Susilo et al., 2024).

The characteristics of Sport Education are also relevant to the requirements of motor learning. Its seasonal structure allows skill practice to occur repeatedly across several learning sessions rather than through isolated activities. Team membership and roles such as player, captain, scorekeeper, or referee provide students with different forms of participation and responsibility during physical education (Preuss et al., 2021). Modified competitions also provide contexts in which movement skills can be repeatedly practiced and applied in game situations (Baena-Extremera et al., 2021). Sport Education may therefore provide learning conditions relevant to motor development through structured practice and active participation, without assuming that implementation of the model necessarily causes improvements in students' motor skills.

Previous studies on Sport Education have largely examined outcomes related to motivation, active participation, social interaction, playing skills, and tactical understanding (Kurniawan & Hanief, 2022; Fysentzidis et al., 2025). Much of the existing evidence has also been generated in secondary-school or broader physical education contexts. In comparison, empirical research specifically examining changes in fundamental motor skills among elementary

https://doi.org/10.29407/js_unpgri.v12i2.28490
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school students, particularly fifth-grade students, remains limited (Sanmiguel-Rodríguez & Álvarez, 2022). Evidence addressing this issue within the Indonesian elementary physical education context is also relatively scarce. This limitation leaves an empirical gap concerning motor skill changes following Sport Education among younger learners.

Current developments in physical education increasingly emphasize model-based practice that provides structured, systematic, and developmentally appropriate learning experiences (Momdjian et al., 2023). Within this perspective, the novelty of the present study lies not in proposing Sport Education as a new instructional model, but in examining its implementation in relation to motor skill changes among fifth-grade elementary school students within a local Indonesian physical education context. Specifically, the study examines coordination, agility, balance, and speed as motor skill indicators and considers both differences between pretest and posttest outcomes and the magnitude of the observed changes. This focus extends the empirical application of Sport Education to a population and educational context that remain comparatively underexplored.

Investigating this issue is important because motor skills developed during elementary school provide a foundation for participation in physical activity and more complex sport activities at later stages (Lalusu et al., 2024; Fantiro et al., 2025). Limited or less appropriate motor learning experiences may restrict students' opportunities to develop the movement competence needed for such participation. Accordingly, instructional models that provide structured and developmentally appropriate opportunities for motor practice require continued empirical examination rather than being assumed to produce similar outcomes across populations and educational contexts.

Accordingly, this study aims to examine changes in motor skills among fifth-grade elementary school students following the implementation of the Sport Education model. Specifically, the study examines differences in motor skill outcomes before and after implementation and the magnitude of the

observed changes. The study is expected to provide empirical evidence regarding motor skill changes following Sport Education within this specific elementary physical education context and to provide information relevant to physical education teachers when considering structured and developmentally appropriate approaches to motor learning.

METHOD

This study employed a quantitative pre-experimental one-group pretest–posttest design to examine changes in students' motor skills before and after the implementation of the Sport Education model. The same participants completed a pretest before the intervention and a posttest after the intervention using the same motor skill assessment (Chiu et al., 2023; Darmawan & Suparman, 2019). This design was selected because practical constraints in the school setting limited the establishment of a control group. Consequently, the absence of a comparison group limits internal validity and prevents definitive causal inference regarding the observed changes. To minimize potential bias, the intervention was conducted under consistent learning conditions, including standardized instructional procedures, equal treatment duration, and uniform pretest and posttest procedures.

The study was conducted at an elementary school during the second semester of the 2025/2026 academic year. Participants consisted of 30 fifth-grade students aged 10–11 years. All eligible students in the selected class were included using a total sampling technique. Students were eligible to participate if they were able and willing to participate in regular physical education activities and complete the study procedures, maintained stable attendance, and had relatively homogeneous initial ability based on teacher evaluation. Students who did not complete the intervention sessions, missed either the pretest or posttest assessment, or had medical conditions that restricted their participation in physical education activities were excluded.

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Participants represented a natural classroom setting without specific grouping based on gender or physical condition.

The researchers obtained permission to conduct the study from the relevant authorities before data collection. Written informed consent was obtained from the students' parents or legal guardians. Participation was voluntary, and the confidentiality and anonymity of all participants were maintained throughout the study.

The independent variable was the implementation of the Sport Education model, whereas the dependent variable was students' motor skills. The motor skill indicators assessed were coordination, agility, balance, and speed. Coordination refers to the ability to integrate body movements effectively, agility to the ability to change direction quickly and accurately, balance to the ability to maintain body stability in stationary or moving conditions, and speed to the ability to perform movement within a short period.

The intervention consisted of eight physical education sessions, with each session lasting 2 × 35 minutes in accordance with the school's physical education schedule. The Sport Education model was implemented through permanent team formation, simple role assignments, fundamental motor skill practice, modified games, team-based competition in a seasonal format, and reflection. Students were assigned roles such as players, team captains, and scorekeepers. Each session consisted of a warm-up, skill practice, modified games or competition, and a cool-down followed by reflection. The teacher acted as a facilitator and supervisor by providing instructions, monitoring students' participation, and giving feedback throughout the learning activities. The learning activities were adapted to the developmental characteristics of elementary school students through simplified rules, small-team organization, and play-based activities emphasizing cooperation, sportsmanship, and active participation.

Students' motor skills were assessed using field-based motor performance tests developed with reference to established motor performance

assessment frameworks and fundamental movement skill evaluation procedures. The assessment consisted of a zigzag run for agility, a 30-meter sprint for speed, a static balance test for balance, and a ball throwing and catching test for coordination. Each test was administered using standardized instructions and identical testing procedures at pretest and posttest. Participant performance was recorded according to predefined scoring criteria for each component, and the resulting scores were combined using the instrument scoring procedure and converted to a 0–100 scale for statistical analysis.

The instrument underwent content validity and reliability evaluation before its use. Content validity was assessed through expert judgment involving three physical education experts: two university lecturers in physical education and one experienced elementary school physical education teacher. The experts evaluated the correspondence between the test components and motor skill indicators as well as the clarity and suitability of the instrument for elementary school students. Aiken's V was used to determine agreement among the experts, with values ranging from 0.81 to 0.92. Minor revisions were made based on their feedback. Reliability analysis using Cronbach's alpha yielded a coefficient of 0.87, indicating adequate internal consistency.

Data collection was conducted in three stages. First, participants completed the pretest to obtain baseline motor skill scores. Second, the Sport Education intervention was implemented over eight physical education sessions. Third, participants completed the posttest using the same motor skill assessment under comparable testing conditions. These procedures enabled within-participant comparison of motor skill scores before and after the intervention.

Data were analyzed using descriptive and inferential statistics. Descriptive statistics included the mean, standard deviation, minimum score, and maximum score. Prior to hypothesis testing, normality was examined using the Shapiro–Wilk test. Data were considered normally distributed when $p > .05$. When the normality assumption was satisfied, differences between pretest and

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posttest scores were analyzed using a paired-samples *t*-test at a significance level of .05. If the normality assumption was not met ($p \leq .05$), the Wilcoxon signed-rank test was specified as the non-parametric alternative.

The magnitude of the observed pretest–posttest difference was examined using Cohen's *d*, calculated as:

$$d = \frac{M_{\text{post}} - M_{\text{pre}}}{SD_{\text{pooled}}}$$

where *Mpost* and *Mpre* represent the posttest and pretest means, respectively, and *SD*pooled represents the pooled standard deviation. Cohen's d values of 0.20–0.49, 0.50–0.79, and ≥ 0.80 were interpreted as small, medium, and large effects, respectively.

Normalized gain was calculated as:

$$g = \frac{X_{\text{post}} - X_{\text{pre}}}{X_{\text{max}} - X_{\text{pre}}}$$

where *Xpost* represents the posttest score, *Xpre* represents the pretest score, and *Xmax* represents the maximum possible score. Following Hake (1998), normalized gain was categorized as low when $g < 0.30$, medium when $0.30 \leq g < 0.70$, and high when $g \geq 0.70$. Descriptive comparisons were also conducted for the coordination, agility, balance, and speed indicators.

RESULTS

Descriptive statistics showed an increase in students' motor skill scores after implementing the Sport Education model. The mean pretest score was 67.93 (SD = 7.01), with scores ranging from 55 to 80, whereas the mean posttest score was 83.26 (SD = 6.78), with scores ranging from 70 to 95. The mean difference between pretest and posttest scores was 15.33 points. The minimum score increased from 55 to 70, while the maximum score increased

from 80 to 95, indicating an overall upward shift in motor skill scores across the observed group.

Table 1. Descriptive Statistics of Pretest and Posttest Scores

Variable	*N*	*M*	*SD*	Minimum	Maximum
Pretest	30	67.93	7.01	55	80
Posttest	30	83.26	6.78	70	95

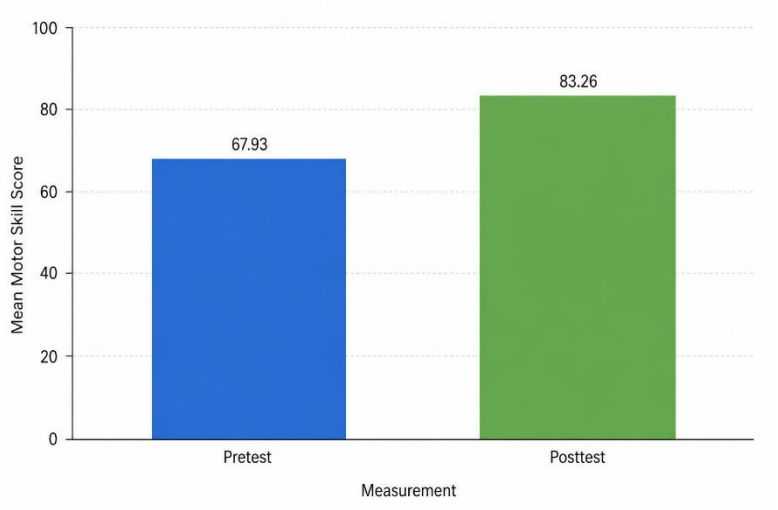

Figure 1. Comparison of Mean Pretest and Posttest Motor Skill Scores

Figure 1 illustrates the increase in mean motor skill scores from 67.93 at pretest to 83.26 at posttest, visually confirming the descriptive increase observed after implementing the Sport Education model.

Prior to hypothesis testing, normality was assessed using the Shapiro–Wilk test. The results showed p = .315 for the pretest scores and p = .427 for the posttest scores. Both values exceeded .05, indicating that the normality assumption was satisfied. Therefore, a paired-samples t-test was used to examine the difference between pretest and posttest motor skill scores.

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Table 2. Shapiro–Wilk *p* Normality Test Results

Variable	Shapiro–Wilk-*p-value*	Interpretation
Pretest	.315	Normal
Posttest	.427	Normal

The paired-samples t-test revealed a statistically significant difference between pretest and posttest motor skill scores, $t(29) = 10.42$, $p < .001$. The mean difference was 15.33 points (SD = 5.18), with a 95% CI of [13.40, 17.26]. These results indicate that posttest motor skill scores were significantly higher than pretest scores within the observed group. Cohen's d was 1.90, indicating a large magnitude of the observed pretest–posttest difference.

Table 3. Paired-Samples t-Test and Effect Size Results

Comparison	Mean Difference	SD	*t*	df	*p*	Cohen's *d*	Effect Size Category
Pretest–Posttest	15.33	5.18	10.42	29	< .001	1.90	Large

Normalized gain analysis yielded a mean g of 0.60, which was classified as medium. At the individual level, 12 students (40%) were classified in the high-gain category, 15 students (50%) in the medium-gain category, and three students (10%) in the low-gain category. Thus, 90% of participants were classified as having medium or high normalized gains, indicating that most participants showed an increase in motor skill scores.

Table 4. Distribution of Student Normalized Gain Categories

Category Gain	Number of Students	Percentage (%)
High	12	40%
Medium	15	50%
Low	3	10%
Total	30	100%

Descriptive analysis of the individual motor skill indicators showed higher posttest mean scores across all four indicators. Coordination increased from 68.10 to 84.20, representing a difference of 16.10 points. Agility increased from 66.50 to 82.90, with a difference of 16.40 points. Balance increased from 69.00 to 83.70, with a difference of 14.70 points, while speed increased from 67.10 to 82.30, representing a difference of 15.20 points. Among the four indicators, agility showed the largest descriptive increase, whereas balance showed the

smallest. Nevertheless, all indicators demonstrated higher mean scores at posttest than at pretest.

Table 5. Mean Scores for Each Motor Skill Indicator

Indicator	Pretest	Posttest	Difference
Coordination	68.10	84.20	16.10
Agility	66.50	82.90	16.40
Balance	69.00	83.70	14.70
Speed	67.10	82.30	15.20

DISCUSSION

The findings showed a substantial increase in students' motor skill scores following the implementation of the Sport Education model. The mean score increased from 67.93 at pretest to 83.26 at posttest, with a mean difference of 15.33 points. This difference was statistically significant, $t(29) = 10.42$, $p < .001$, and was accompanied by a large effect size (Cohen's $d = 1.90$). The normalized gain of 0.60 was classified as medium, with 90% of participants achieving medium or high gain. Changes were also observed across all measured motor skill indicators, including coordination, agility, balance, and speed. These findings are consistent with previous empirical evidence indicating that Sport Education may provide structured opportunities for motor skill development through sustained participation in physical education activities (Ishak et al., 2025). However, because this study employed a one-group pretest–posttest design without a control group, the observed changes cannot be attributed exclusively to the intervention. They should not be interpreted as definitive evidence of a causal effect.

The observed changes may be understood in relation to the pedagogical characteristics of Sport Education. The model incorporates structured learning seasons, stable team membership, role assignments, formal competition, and opportunities for repeated skill practice. Within the present intervention, students participated in fundamental motor skill practice, modified games, and team-based competition across eight physical education sessions. Repeated, structured practice supports the development and refinement of movement skills (Magill & Anderson, 2021), while model-based practice emphasizes

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systematic, developmentally appropriate learning experiences that can support student learning (Momdjian et al., 2023). These characteristics offer a plausible context for understanding the observed motor skill changes. However, they should be regarded as literature-based interpretations rather than mechanisms directly established by the present study.

Team-based participation represents another characteristic of Sport Education that may be relevant to the findings. Previous research has indicated that cooperative learning environments can support student involvement, accountability, and peer collaboration in physical education (Özdemir & Yıldız, 2022). Within Sport Education, stable team membership and roles such as players, team captains, and scorekeepers give students opportunities to participate in different aspects of the learning process rather than solely following teacher-directed instruction. Such participation may create more consistent opportunities for movement practice during learning activities. Role-based participation has also been associated with autonomy, engagement, and sustained participation in physical education (O'Connor et al., 2024). Nevertheless, this study did not directly measure motivation, engagement, autonomy, or participation intensity. Their possible contribution to the observed motor skill changes should therefore remain a literature-based interpretation rather than an empirical conclusion from the present data.

The modified and contextualized game activities incorporated into the intervention may also provide a relevant context for interpreting the findings. Unlike isolated skill practice, game-based activities allow students to apply movement skills within dynamic situations that require continuous movement adjustment and responses to changing conditions. Previous research has indicated that contextualized game-based approaches can support the application of movement skills within game situations (Tanaka & Reilly, 2021). In the present study, modified games and team-based competition provided repeated opportunities to apply the motor skills practiced during physical education. This interpretation is also consistent with the role of repeated

practice in motor learning, which provides opportunities for movement refinement and skill adaptation over time (Schmidt & Lee, 2019). However, the specific contribution of the modified games was not examined independently and therefore cannot be isolated from the other components of the Sport Education intervention.

At the indicator level, coordination increased from 68.10 to 84.20, agility from 66.50 to 82.90, balance from 69.00 to 83.70, and speed from 67.10 to 82.30. The largest numerical increase was observed in agility (16.40 points), followed by coordination (16.10 points), speed (15.20 points), and balance (14.70 points). The relatively greater descriptive change in agility may be considered in relation to the dynamic movement demands commonly involved in game-based physical activities, including changes in direction and responses to changing movement situations. This interpretation is consistent with previous research linking game-based and variable practice environments with agility development (Makorohim et al., 2022). Nevertheless, because inferential statistical comparisons were not conducted between the individual motor skill indicators, these differences should be interpreted descriptively and do not demonstrate that Sport Education was more strongly associated with changes in agility than with the other motor skill components.

From a pedagogical perspective, the findings are consistent with literature suggesting that model-based practice can provide structured and student-centered learning environments in physical education (Siedentop & Van Der Mars, 2022). Sport Education combines team membership, structured learning activities, role-based participation, repeated practice, and contextualized game experiences within a sustained learning sequence. These characteristics may provide elementary school students with opportunities to participate actively and repeatedly apply motor skills in meaningful learning situations. However, the present study assessed motor skill performance rather than students' motivation, engagement, autonomy, or perceptions of the learning environment. Consequently, these pedagogical characteristics should be

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considered possible explanations for the observed changes rather than additional outcomes demonstrated by this study.

This study's primary contribution lies in the empirical context in which the motor skill changes were examined. The study provides quantitative evidence of pretest–posttest changes in coordination, agility, balance, and speed among fifth-grade elementary school students following an eight-session Sport Education intervention. This extends the empirical examination of Sport Education to younger learners and motor skill outcomes within an elementary physical education context. Rather than establishing the effectiveness of Sport Education or identifying the mechanisms responsible for the observed changes, the findings provide context-specific evidence that can inform further investigation of Sport Education and motor skill development among elementary school students.

Several limitations should be considered when interpreting these findings. First, the one-group pretest–posttest design did not include a comparison or control group, limiting internal validity and preventing the observed changes from being attributed exclusively to the Sport Education intervention. Second, the relatively small sample drawn from a single school limits the generalizability of the findings to broader elementary school populations. Third, the intervention was conducted over only eight physical education sessions, and no follow-up measurement was undertaken to determine whether the observed changes were maintained over time. Future studies should employ more rigorous quasi-experimental or randomized controlled designs, involve larger and more diverse samples, and incorporate longer follow-up periods to examine the sustainability of changes in students' motor skills.

CONCLUSION

This study documented positive changes in motor skills among fifth-grade elementary school students following the implementation of the Sport Education model. Motor skill scores increased from pretest to posttest, with

improvements observed across coordination, agility, balance, and speed. The findings provide context-specific evidence regarding motor skill changes following an eight-session Sport Education intervention in elementary physical education. However, because the study employed a one-group pretest–posttest design without a control group, the observed changes cannot be attributed exclusively to the intervention. Future research involving comparison groups, larger and more diverse samples, and longer follow-up periods is needed to provide stronger evidence regarding the role of Sport Education in supporting motor skill development among elementary school students.

ACKNOWLEDGMENT

The author gratefully acknowledges the principal, fifth-grade teachers, and students who participated in this study for their support and cooperation throughout the research process. Appreciation is also extended to colleagues and other parties who provided valuable input and assistance during the preparation of the research, instrument development, data collection, and data analysis.

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