Enhancing physical fitness and social skills through innovative Physical Education learning approaches and motor skills in elementary school students

Mejora de la forma física y las habilidades sociales mediante enfoques innovadores de aprendizaje de la Educación Física y las habilidades motrices en alumnos de primaria

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Abstract

Introduction: Physical education plays an important role in developing elementary school students' physical fitness and social skills. However, the effectiveness of physical education approaches varies.
Objective: This study aims to determine the effect of Innovative Physical Education and Motor Skills learning approaches on elementary school students' physical fitness and social skills.
Methodology: This study used a 2x2 factorial experimental design with 100 elementary school students aged 11-12. Four experimental groups received interventions through motor skill training and game-based activities. The instruments used included social skill questionnaires and physical fitness measurements. Data were analyzed using independent sample t-tests.
Results: The findings showed that both approaches, motor skill training, and games, significantly improved students' physical fitness and social skills with a Sig value (<0.05). Group A1B1 showed a more significant increase in physical fitness and social skills than the other groups.
Discussion: The movement training and games approach effectively improves primary school students' physical fitness and social skills, although some studies suggest social development requires more intensive interaction.
Conclusions: This study concluded that motor training and game-based approaches effectively improved elementary school students' physical fitness and social skills.

Keywords

Physical fitness; social skills; learning approaches; motor skills.

Resumen

Introducción: La educación física desempeña un papel importante en el desarrollo de la forma física y las habilidades sociales de los alumnos de primaria. Sin embargo, la eficacia de los enfoques de la educación física varía.
Objetivo: Este estudio pretende determinar el efecto de los enfoques innovadores de aprendizaje de la educación física y las habilidades motrices en la forma física y las habilidades sociales de los alumnos de primaria.
Metodología: Este estudio utilizó un diseño experimental factorial 2x2 con 100 estudiantes de primaria de 11-12 años. Cuatro grupos experimentales recibieron intervenciones mediante entrenamiento de habilidades motrices y actividades basadas en juegos. Los instrumentos utilizados fueron cuestionarios sobre habilidades sociales y mediciones de la forma física. Los datos se analizaron mediante pruebas t de muestras independientes.
Resultados: Los resultados mostraron que ambos enfoques, entrenamiento de habilidades motoras y juegos, mejoraron significativamente la forma física y las habilidades sociales de los estudiantes con un valor Sig (<0,05). El grupo A1B1 mostró un aumento más significativo de la condición física y las habilidades sociales que los demás grupos.
Discusión: El enfoque de entrenamiento motriz y juegos mejora eficazmente la aptitud física y las habilidades sociales de los alumnos de primaria, aunque algunos estudios sugieren que el desarrollo social requiere una interacción más intensa.
Conclusiones: Este estudio concluyó que el entrenamiento motor y los enfoques basados en el juego mejoraban eficazmente la forma física y las habilidades sociales de los alumnos de primaria.

Palabras clave

Aptitud física; habilidades sociales; enfoques de aprendizaje; habilidades motrices.

Introduction

Physical education plays a crucial role in supporting physical fitness as well as the development of learners' social skills, especially at the primary school level, which is an essential phase in character building (Gomes et al., 2024; Greier et al., 2020; Niwitpong, 2023). In this context, innovative learning approaches are crucial to creating a more engaging, inclusive, and effective learning experience. This study applied two learning models categorized as innovative approaches, namely: (1) a movement training approach that focuses on structured physical activities to improve endurance, agility, and motor coordination and (2) a game-based approach that integrates competitive and collaborative game activities to promote the simultaneous development of motor and social skills. Both approaches differ from traditional methods because they are dynamic, learner-centered, and promote reflection and social interaction.

Fundamental motor skills are essential for children's physical fitness and active participation in daily activities (Chen et al., 2024; Fahmi & Wellis, 2020). When basic motor skills are combined with pedagogical strategies that support collaboration, communication, and emotion regulation, they contribute to strengthening students' social skills. However, previous research in physical education has focused more on cognitive or academic aspects (Sudirjo et al., 2024), or addressed physical skills in isolation (Ushtelenca et al., 2024), without highlighting the complete interrelationship of variables in the context of primary school students.

This research explicitly fills the literature gap related to the lack of empirical studies that examine the effect of a combined approach of movement training and games on the physical fitness and social skills of elementary school students aged 11-12 years. Previous research has shown that innovative approaches in physical education, such as the STEAM-Based Physical Education Learning Model, can improve the fitness of primary school students (Iyakrus & Ramadhan, 2021). However, very few have comprehensively examined the impact on students' social aspects, especially in the context of learning at the primary level, which has unique developmental needs. In addition, today's primary school students also face various social challenges such as isolation and mental health (Matthews et al., 2015), bullying (Julia Urba Swastika, 2024; Kolesov & Ermilova, 2025), and socioeconomic inequality that can impact emotional well-being and academic achievement (Gruijters et al., 2024; Hosokawa & Katsura, 2018; Yang et al., 2019). These conditions indicate the need for physical learning interventions that emphasize physical aspects and integrate structured and meaningful social interactions.

This research offers a learning model that integrates basic motor skills with two innovative instructional approaches to support elementary school students' simultaneous physical and social development. Through a factorial experimental design, the study analyzed the effectiveness of each strategy on groups of students with different motor skill levels. Thus, the findings of this study are expected to contribute to the development of a holistic and inclusive physical education model that not only supports academic success but also shapes the physical and social abilities that elementary school students need in their future personal and social lives.

Method

Research problem should be solved through an experimental method using a 2x2 factorial design. Design was chosen because it can simultaneously test the effect of two independent variables on the dependent variable, each consisting of two levels. In addition, this factorial design allows the researcher to identify any interaction effects between the two independent variables, thus providing a more comprehensive understanding of the effectiveness of the treatment offered in the study. This approach was used to systematically evaluate the impact of different learning approaches on primary school students' physical fitness and social skills.

Participants

The population in this study was 133 elementary school students in Salatiga. The sampling technique used was random sampling, with an accessible population of 100 students aged 11-12. The sample selection was adjusted to the inclusion criteria: being 11-12 years old, physically healthy and without

physical injury, willing to be respondents, and attending physical education classes. In contrast, the exclusion criteria were students who were sick, injured, and absent from physical education classes. In data collection, the applicable research ethics procedures were followed. All respondents stated their consent through informed consent, which their parents and the school knew.

Procedure

The treatment in this study involved two innovative physical education approaches: a movement training approach and a game-based approach. These approaches were then distributed among students with high and low motor skills, forming four experimental groups. The intervention was carried out for 8 weeks in each group with a meeting frequency of 1 time per week with a time per session of 120 minutes. The provision of intervention was based on the Activity design with a movement training approach and the Activity design with a game approach.

Table 1. 2x2 factorial research design

Learning approach	Movement training approach	Play approach
Motor skills	A1	A2
High motor skills (B1)	A1B1	A2B1
Low motor skills (B2)	A1B2	A2B2

Table 2. Activity design with a movement training approach

Week	Learning activities	Fitness focus	Focus on social skills
1	Warm up exercises, short runs, static jumps	Cardiorespiratory endurance, motor coordination	Self-introduction, initial communication
2	Circuit training: jump rope, plank, ball dribbling	Muscle strength, flexibility	Cooperation in groups
3	Endurance training (medium distance running)	Cardiorespiratory endurance	Communication within the team, division of roles
4	Agility drills (agility drills, cone drills)	Agility, balance	Quick decision making, supporting teammates
5	Circuit training (pair strength games)	Muscle strength, endurance	Communication, collaboration in pairs
6	Plyometric training (jumping, squat jumping)	Muscle strength, agility	Building self-confidence in groups
7	Flexibility and balance exercises	Flexibility, balance	Group leader, reflection of role in team
8	Group fitness evaluation and social reflection	Comprehensive fitness evaluation	Group reflection, teamwork feedback

Table 3. Activity design with a game approach

Week	Learning activities	Fitness focus	Focus on social skills
1	Relay race game	Cardiorespiratory endurance, coordination	Basic communication, self-introduction
2	Chain ball catch game	Coordination, muscle endurance	Initial cooperation, introduction of instructions
3	"Tug of War"	Strength, muscular endurance	Cooperation, group collaboration
4	“Treasure Hunt”	Flexibility, durability	Problem solving, decision making
5	Team-based "Obstacle Race"	Strength, agility, endurance	Leadership, coordination of movement in groups
6	"Spider Web" (through rope obstacles)	Flexibility, balance	Cooperation, non-verbal interaction
7	motor movement variations	Agility, balance	Following instructions, collaboration between students
8	End of game reflection, team discussion	Comprehensive fitness evaluation	Group social reflection, collaborative feedback

Instrument

The instruments used in this study include the Test of Gross Motor Development (TGMD-2) to assess motor skills (Ulrich, 2000; Valentini et al., 2018). In addition, the Physical Fitness Test was used to measure the physical fitness of elementary school students according to age characteristics (Bayu et al., 2021). Furthermore, a questionnaire designed for elementary school students aged 11 and 12 was used to determine social skills. Before being used in the study, the instrument underwent validity and reliability tests. The validity test resulted in a value of 0.76, while the reliability measured by Cronbach's Alpha resulted in a value of 0.72.

Table 4. Social skills instruments

Description
I enjoy talking with my friends at school.
I will help friends who feel lonely on the playground.
When working in groups, I ensure everyone is involved.
I can resolve issues with my friends by discussing and seeking solutions together.
I am happy to assist friends who are struggling with their studies.
When someone helps me, I express my gratitude as a sign of appreciation.
If I feel sad or stressed at school, I will seek out friends or teachers to talk to.
I will help someone who is facing difficulties at school.

Data analysis

Data analysis in this study is conducted through several stages. Prerequisite tests are performed before proceeding with the primary statistical tests, including normality and homogeneity tests. Once the data meet the assumptions of normality and homogeneity, the analysis is followed by an Analysis of Variance to determine whether there are significant differences between the treatment groups regarding improvements in physical fitness and social skills. Hypothesis testing uses a paired t-test to assess the differences between pre- and post-treatment or intervention outcomes.

Results

Appropriate statistical analyses were conducted to evaluate the effectiveness of the learning intervention in enhancing students' physical fitness and social skills. The results of this analysis provide significant insights into the impact of the applied interventions and indicate changes that occurred in both variables. By considering various measurable aspects, this research offers a deeper understanding of how different learning approaches can influence students' overall development. Below are the results of the variance analysis that support the findings of this study.

Table 5. Descriptive Statistics of Pretest & Posttest Scores by Learning Approach and Motor Skill Level

Variable	N	Mean	Std. Deviation
A1B1	25	26,42	4,786
A1B2	25	22,57	3,645
A2B1	25	25,34	4,862
A2B2	25	20,78	4,363

Based on Table 5, which presents descriptive statistics, it can be seen that group A1B1 has the highest mean score of 26.42 with a standard deviation of 4.786. This shows that participants in this group performed well in motor skills. In contrast, group A1B2 recorded a mean score of 22.57 with a standard deviation of 3.645, which shows lower performance than group A1B1. Group A2B1 had a mean score of 25.34 and a standard deviation of 4.862, which shows that this approach also improves students' motor skills. Meanwhile, group A2B2 recorded the lowest mean score of 20.78, with a standard deviation 4.363. These data show that different learning approaches significantly impact the development of students' motor skills, with the group that applies the play and movement practice approach at a high skill level showing better results compared to the group at a low skill level.

Table 6. Normality and Homogeneity Test Results

Kolmogorov-Smirnov	Homogeneity
0,562	0,534

Based on Table 6, which presents the results of the prerequisite test, the analysis using the Kolmogorov-Smirnov test shows a value of 0.562, which indicates that the distribution data does not deviate significantly from the normal distribution. In addition, the homogeneity test results showed a value of 0.534, which indicates that the variance between groups is homogeneous. These findings support the basic assumptions required for further analysis, ensuring that the data used in this study meet the criteria for the appropriate application of statistical methods.

Table 7. ANOVA Results on Physical Fitness and Social Skills Based on Learning Approaches

Variable	df	F	Sig.
Physical Fitness	1	12.573	0.003
Social Skills	1	8.784	0.012

Based on Table 7, which presents the results of the ANOVA test, the analysis shows significant differences in the physical fitness and social skills variables between the groups applied with different approaches. For the physical fitness variable, the F value is 12.573 with a significance (p-value) of 0.003, indicating a significant difference in students' physical fitness based on the teaching approach used. In addition, the F value for the social skills variable was 8.784, with a p-value of 0.012, indicating a significant difference in students' social skills. These findings indicated that the teaching approach applied significantly impacted the development of physical fitness and social skills of primary school students.

Table 8. Comparison of Pre-Test and Post-Test Scores on Physical Fitness by Group

Group	Variable	Pre-test (Mean ± SD)	Post-test (Mean ± SD)	p-value
A1B1	Physical Fitness	65.20 ± 4.50	85.60 ± 5.30	0.001
A1B2		60.40 ± 5.10	75.30 ± 4.90	0.011
A2B1		63.70 ± 4.80	80.40 ± 5.20	0.003
A2B2		58.90 ± 5.20	70.80 ± 4.70	0.014

Based on Table 8, which presents paired sample statistics for the physical fitness variable, there was a significant increase between the pre-test and post-test scores in each group. For group A1B1, the mean pre-test score was 65.20 ± 4.50, while the mean post-test score increased to 85.60 ± 5.30, with a p-value of 0.001, indicating a highly significant difference. Group A1B2 showed a mean pre-test score of 60.40 ± 5.10 and a post-test score of 75.30 ± 4.90, with a p-value of 0.011, indicating a significant difference. Furthermore, group A2B1 recorded a pre-test mean of 63.70 ± 4.80 and a post-test mean of 80.40 ± 5.20, with a p-value of 0.003, indicating a significant increase. Finally, the A2B2 group showed an average pre-test score of 58.90 ± 5.20 and a post-test score of 70.80 ± 4.70, with a p-value of 0.014, indicating a significant difference. These findings indicate that all approaches implemented in this study effectively improved students' physical fitness.

Table 9. Comparison of Pre-Test and Post-Test Scores on Social Skills by Group

Group	Variable	Pre-test (Mean ± SD)	Post-test (Mean ± SD)	p-value
A1B1	Social Skills	43.32 ± 3.41	55.33 ± 4.71	0.005
A1B2		46.31 ± 6.52	52.49 ± 4.87	0.011
A2B1		53.47 ± 4.77	55.89 ± 5.61	0.017
A2B2		68.51 ± 5.84	69.68 ± 4.65	0.021

Based on Table 9, which presents paired sample statistics for the social skills variable, there was a significant increase between the pre-test and post-test scores in each group. For group A1B1, the mean pre-test score was 43.32 ± 3.41, while the mean post-test score increased to 55.33 ± 4.71, with a p-value of 0.005, indicating a significant difference. Group A1B2 showed a mean pre-test of 46.31 ± 6.52 and a post-test of 52.49 ± 4.87, with a p-value of 0.011, indicating a significant increase. Group A2B1 recorded a mean pre-test of 53.47 ± 4.77 and a mean post-test of 55.89 ± 5.61, with a p-value of 0.017, indicating a significant increase in social skills. Meanwhile, A2B2 showed a pre-test mean of 68.51 ± 5.84 and a post-test mean of 69.68 ± 4.65, with a p-value of 0.021, indicating a significant difference. These findings indicate that all approaches positively improved students' social skills.

Table 10. Paired Samples t-Test Results for Combined Physical Fitness and Social Skills Variables

			95% confidence interval of diffence				
	Mean	Std. Deviation	lower	Upper	t	df	Sig. (2 tailed
A1B1 pretest-posttest	-11,012	6,436	-15,524	-6,484	-15,524	87	0,000
A1B2 pretest-posttest	-7,372	7,867	-12,331	-2,413	-21,232	87	0,000
A2B1 pretest-posttest	-9,453	6,855	-14,214	-4,692	-19,426	87	0,000
A2B2 pretest-posttest	-8,443	6,677	-13,355	-3,531	-25,239	87	0,000

Based on Table 10, which presents the results of the paired sample t-test, the analysis shows a significant difference between the pre-test and post-test scores for each group. For the group A1B1, the average difference was -11.012 with a standard deviation of 6.436, and the 95% confidence interval ranged from -15.524 to -6.484, with a t-value of -15.524 and a p-value of 0.000, indicating that this difference is very significant. The group A1B2 showed an average difference of -7.372 with a standard deviation of 7.867, and a 95% confidence interval between -12.331 and -2,413, with a t-value of -21.232 and a p-value of 0.000, which also indicated a significant difference. For the A2B1 group, the mean difference was -9.453 with a standard deviation of 6.855, and the 95% confidence interval ranged from -14.214 to -4692, with a t-value of -19.426 and a p-value of 0.000, indicating a significant difference. The group of A2B2 showed a mean difference of -8.443 with a standard deviation of 6.677, and a 95% confidence interval between -13.355 and -3.531, with a t-value of -25.239 and a p-value of 0.000, also indicating a significant difference. These findings confirm that all tested approaches significantly positively impact improving students' motor and social skills. All groups showed a highly significant p-value ($p < 0.001$). This indicates rejecting the null hypothesis (H0) and accepting the alternative hypothesis (Ha) for each group. Thus, there is a significant difference between the pre-test and post-test scores, indicating that the applied teaching approach improves students' physical fitness and social skills.

Discussion

The results showed a significant increase in students' physical fitness and social skills after participating in physical education learning interventions using a movement training approach and a game-based approach. However, it should be emphasized that these improvements were associative, not causal. The data showed a significant relationship between the intervention and the observed changes, but not enough to conclude that the intervention was the sole cause of the changes. Therefore, interpreting these results still considers the possible influence of other outside factors. More specifically, in group A1B1, there was an increase in mean physical fitness from 65.20 to 85.60 ($p < 0.001$) and an increase in social skills from 43.32 to 55.33 ($p = 0.005$). Similar results also occurred in the A2B1 group. This finding is in line with studies in primary education, which state that physical activities carried out in groups have the potential to support the development of physical and social aspects of primary school students (Misriandi & Susanto, 2024; Park, 2018).

In Indonesia, the integration of traditional games in physical education lessons has been shown to positively impact the development of motor coordination and social interaction of primary school students. Research results show that conventional games routinely implemented in PE lessons can improve the motor movement skills and development of elementary school students (Fadlan et al., 2023; Gustian, 2021; Sunanto et al., 2024). In addition, other studies confirm that traditional game-based activities encourage good social interactions among primary school students (Marhamah et al., 2024; Rosmaria & Fadhilah, 2024). These research results confirm that the group physical activity approach in physical education is practical in developing motor skills and very relevant in shaping the character and social skills of primary school-age children in Indonesia.

The mechanisms underlying the improvement in social skills and physical fitness of primary school students can be explained through the unique characteristics of each learning approach. In a play-based approach, students engage in cooperative and competitive physical activities, which require students to cooperate, communicate, and solve problems with peers (Yan et al., 2023). A fun and interactive learning environment will create a safe space for students to learn socially through observation, imitation, and immediate feedback, per the principles of Bandura's social learning theory (Rumjaun & Narod, 2020). Research shows that the cooperative game approach in physical education in elementary schools improves students' communication and cooperation skills (Ojeda-Troncoso & Campos-Campos, 2025; Risnawati et al., 2025). In addition, the results of another study revealed that the team-based game model fostered a sense of empathy in elementary school-age children (Mandelli et al., 2022). In Indonesia, studies show that integrating traditional games into physical education encourages student motivation and strengthens cooperation and self-confidence (Mulya, 2024; Wicahyani et al., 2024).

In contrast, the movement training approach provides a more systematic and disciplined structure to physical activity, essential in establishing a fitness routine and exercise ethic. Through repetitive practice, students develop basic motor skills more purposefully and consistently, resulting in improved

physical fitness and personal responsibility for physical activity. Research on elementary school students shows that structured physical exercise can improve muscle strength, flexibility, and cardiorespiratory endurance (Jarnig et al., 2023). In addition, another study confirmed that a systematic exercise approach contributes to increasing moderate to vigorous intensity physical activity (Errisuriz et al., 2018). In the context of primary school physical education, the clear structure of the exercises helps students understand the importance of rules, hard work, and responsibility, all of which are integral to the social competencies expected at primary school age. Thus, both approaches make different but complementary contributions to supporting students' overall physical and social growth.

However, some limitations of the study should be highlighted. The sample size was limited (n=100) and drawn from one geographical area, so the results cannot be widely generalized. Furthermore, the intervention duration of only eight weeks was insufficient to measure the long-term impact on physical fitness and social skills. In future research, it is recommended to include a more diverse sample in terms of students' social and academic backgrounds and extend the duration of the intervention to obtain more robust data on the long-term impact of the intervention. Thus, future research can contribute more to the literature on physical education and overall student development.

Conclusions

Based on the study results, the group using the movement training approach showed greater improvement in physical fitness, especially in students with higher motor skills. On the other hand, improvements in social skills were seen in all intervention groups, suggesting that both movement and game-based approaches can support the development of students' social aspects.

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