

Traditional games for physical fitness: an experimental study on elementary school students Juegos tradicionales para mejorar la forma física: estudio experimental con alumnos de primaria

*Irvan Septianto, *Sumaryanti, *Ahmad Nasrulloh, *Sulistiyono, **Hartman Nugraha, **Masnur Ali, *Aria Malik Ramadhani,
*Julian Dewantara, *Nida Haniyyah, *Fauzi, *Didi Suryadi, *Roy Ardian, ***Subarjo
*Universitas Negeri Yogyakarta, (Indonesia), **Universitas Negeri Jakarta, (Indonesia), ***Universitas Tanjungpura, (Indonesia)

Abstract. Maintaining optimal physical fitness is crucial for students to combat fatigue during activities, allowing them to concentrate on their studies during the learning process at school. Consequently, physical fitness is a fundamental aspect of health that warrants careful consideration. The objective of this study is to enhance students' abilities and promote good physical fitness through the utilization of traditional games. The research employed a pre-experimental design with a one-group pretest-posttest approach. Modified traditional games, including sodor carts, fish nets, and balloon racing, were applied as the treatment. The results of the treatment demonstrated a significance value of 0.000, indicating a notable increase in students' physical fitness after engaging in learning activities through traditional games. This improvement is attributed to the traditional games, which effectively engage children in learning, fostering active participation and contributing to the enhancement of physical fitness. Consequently, the conceptualization of physical learning within the framework of traditional games proves to be applicable and effective.

Keywords: Physical Fitness, Traditional Games, Elementary School, Children's Games

Resumen. Mantener una forma física óptima es crucial para que los estudiantes combatan la fatiga durante las actividades, lo que les permite concentrarse en sus estudios durante el proceso de aprendizaje en la escuela. Por consiguiente, la buena forma física es un aspecto fundamental de la salud que merece una cuidadosa consideración. El objetivo de este estudio es mejorar las capacidades de los estudiantes y promover una buena forma física mediante la utilización de juegos tradicionales. La investigación empleó un diseño pre-experimental con un enfoque pretest-post-test de un grupo. Los resultados del tratamiento demostraron un valor de significación de 0,000, lo que indica un notable aumento de la forma física de los alumnos después de participar en actividades de aprendizaje mediante juegos tradicionales. Esta mejora se atribuye a los juegos tradicionales, que implican eficazmente a los niños en el aprendizaje, fomentando la participación activa y contribuyendo a la mejora de la forma física. Por consiguiente, la conceptualización del aprendizaje físico en el marco de los juegos tradicionales demuestra ser aplicable y eficaz.

Palabras clave: Forma física, Juegos tradicionales, Escuela primaria, Juegos infantiles

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Irvan Septianto

irvanseptianto.2023@student.uny.ac.id

Introduction

Sport is generally defined as a physical activity that proves highly beneficial for maintaining and enhancing overall health (Rubiyatno et al., 2023; Suryadi, Komaini, et al., 2024). Within the realm of physical activities, sports are recognized as a principal strategy to address physical weaknesses, targeting resistance elements like strength, power, aerobics, balance, and flexibility (Angulo et al., 2020). However, engaging in sports carries a notable physiological demand and an inherent risk of injury due to repetitive high-intensity movements such as jumping and running under fatigue (Read et al., 2016). Regular exercise contributes positively to overall fitness, leading to improvements in physical well-being (Hardinata et al., 2021; Mashud et al., 2024). The frequency of sports participation correlates with an individual's level of physical fitness, indicating that more frequent engagement leads to better fitness levels.

Optimal fitness plays a crucial role, not only in resisting fatigue but also in promoting rapid recovery (Van Eetvelde et al., 2021; Vasileios et al., 2018). Every individual, regardless of birth circumstances, has the opportunity to enhance cardiovascular abilities, particularly those who engage in regular exercise and training (Manchado et al., 2018; Tettero et al., 2018). Research suggests that consistent exercise leads to improved fitness and indirectly contributes to overall physical health (Hardinata et al., 2021).

In the context of children's fitness, the role of physical education within the school environment is deemed highly significant. Physical education classes are integral components of the learning process at school, spanning from early childhood education to senior high school (Samodra et al., 2023; Suryadi, Nasrulloh, et al., 2024). These lessons contribute to enhancing human quality by instilling healthy living behaviors based on the principles of physical education (Hardinata, Yosika, et al., 2023; Mashud, Arifin, et al., 2023; Mashud, Warni, et al., 2023; Perdana et al., 2023; Suryadi et al., 2023). The emphasis on physical education correlates with an improvement in the overall quality of life (Aziz, Okilanda, Permadi, et al., 2023; Aziz, Okilanda, Rozi, et al., 2023), underscoring the significant role played by sports education.

Sport education utilizes physical activity as a tool to achieve educational objectives, with activities contributing to overall fitness (Athaya et al., 2023). Learning activities often incorporate play-based methods aimed at enhancing physical health and fitness levels (Cocca et al., 2020). Physical education lessons commonly involve play (Suryadi, Nasrulloh, et al., 2024), fostering fitness in students through physical activity (Hardinata, B, et al., 2023). This aligns with the notion that physical activity promotes health and improves overall fitness (Baek et al., 2020; González-Fernández et al., 2021). Recognizing the importance of good physical fitness, including among elementary school students, is crucial. Research findings in elementary schools

indicate a need for improvement in students' physical fitness, emphasizing its significance for growth and development, including endurance, strength, and balance (Samodra et al., 2023; Suganda et al., 2023). This research aims to enhance physical fitness using traditional games, building on the positive impact identified in previous studies (Gustian, 2021). Traditional games are found to positively influence physical literacy and development in students, stimulating their activity and effectiveness in movement activities (Cocca et al., 2020; Suryadi, Nasrulloh, et al., 2024). Through traditional games, students can develop talents crucial for various physical activities, especially in sports (Merino-Campos & Del Castillo Fernández, 2016).

As a teacher, especially a teacher must be good at sorting and choosing the kinds and forms of games in the learning process. (Aziz, Okilanda, Permadi, et al., 2023; Aziz, Okilanda, Rozi, et al., 2023; Mashud et al., 2024; Tantri et al., 2023; Umar et al., 2023). This is adjusted to the characteristics of students who like to play (Haïdara et al., 2023). With the learning method using the play approach, the teacher can indirectly include the core material, so that at the end of learning students are able to master the material taught by the teacher. (Harianto et al., 2023). These traditional games contain art forms, form cooperation, foster a sense of fun, and foster self-confidence and are also able to improve children's physical fitness. So that fundamental movements are formed which are strongly influenced by maturity, task demands, environmental factors (Goodway et al., 2019).

As teachers, it is essential to adeptly select and incorporate games into the learning process, aligning with students' preferences for play (Aziz, Okilanda, Permadi, et al., 2023; Aziz, Okilanda, Rozi, et al., 2023; Mashud et al., 2024; Tantri et al., 2023; Umar et al., 2023). Utilizing a play-based approach in teaching allows teachers to indirectly incorporate core material, facilitating students' mastery of the subject matter by the end of the learning process (Harianto et al., 2023). Traditional games encompass art forms, encourage cooperation, instill a sense of enjoyment, nurture self-confidence, and contribute to improving children's physical fitness, shaping fundamental movements influenced by maturity, task demands, and environmental factors (Goodway et al., 2019).

The use of traditional games as an approach in children's movement learning activities is considered easy to attract children's attention because the game comes from daily activities in the neighborhood. In addition, the use of traditional games is also able to maintain and develop local wisdom (Gustian, 2021). While previous studies have explored traditional games, their emphasis has primarily been on motor skills, and it's essential to note the distinct variations in traditional games across different countries and regions (Gipit Charles et al., 2017; Gipit et al., 2017; Suryadi, Nasrulloh, et al., 2024). Recognizing this gap, the current research aims to contribute to the existing body of knowledge and highlight the significance of its undertaking. Traditional games play a crucial role not only in the realm

of motor skills but also in the broader context of physical education. It is important to acknowledge that these games can have a profound impact not only on the general population but specifically on children's fitness, which is the central focus of this research. Thus, this study is to analyze the effect of traditional games on the physical fitness of elementary school students.

Methods

Study Design

This research employs an experimental design, specifically a one-group pretest and posttest design. The study initiates by conducting a pretest to assess the initial abilities of students through a test. Subsequently, modified traditional games, including sodor carts, fish nets, and balloon racing, are administered as treatment over 14 sessions. Following the treatment phase, a final test (posttest) is conducted.

Participants

The study was conducted at an elementary school in Indonesia in the 2022/2023 school year. Purposive sampling was used, resulting in the selection of 18 students as participants. These selected students underwent treatment as part of the study to improve their physical fitness and achieve the desired results. The age of the sample in this study is around 8-11 years old. In addition, this research has obtained approval from the parents of students.

Procedure

The research commenced with an initial assessment (Posttest) to gauge the students' baseline physical fitness. Subsequently, efforts were made to enhance the students' physical fitness by incorporating traditional games commonly enjoyed by elementary school students. Modified versions of traditional games, such as sodor carts, fishing nets, and balloon racing, were employed. The rules and equipment of these games were adjusted to align with the students' capabilities and the objectives of the experiment. The game trials spanned two sessions, with the traditional games tested seven times in total over fourteen sessions. Students were organized into groups of four to five individuals, and the game rules were tailored to suit the experimental requirements. Each group engaged in friendly competition to complete tasks or overcome obstacles within the traditional games, adhering to the prescribed rules. Following the intervention, a final assessment (Posttest) was administered to evaluate the students' ultimate physical fitness levels after completing the trial.

Instrument

The instrument utilized for collecting pretest and posttest data is the Indonesian Physical Fitness Test (IPFT), as introduced by (Arif, 2020). This test comprises various components, including a 40-meter short-distance running test, a lying sit test, a hanging elbow bend test (or hanging

body lift test), an upright jump test, and a 600-meter running test. The norms for the Indonesian Physical Fitness Test are detailed in Table 1.

Table 1.
Physical Fitness Test Norms

Total Value	Classification
22-25	Excellent
18-21	Good
14-17	Moderate
10-13	Less
5-9	Very Poor

Data Analysis

Data analysis in this study uses an effect test, before that a normality prerequisite test is carried out if the data is normal, it will be continued with the t test if it is not normal, it uses a non-parametric test which is assisted using the SPSS version 26 application.

Results

Before administering treatment to the students, an initial data collection (pre-test) was undertaken to assess their baseline abilities. The findings indicate that the physical fitness levels of the students were predominantly in the moderate category, comprising 10 students, accounting for 55.6%. The less category included 6 students, representing 33.3%, and 2 students fell into the very poor category, making up 11.1%. These results are summarized in Table 2.

Following the post-test conducted with 18 students, it was observed that 2 students achieved an excellent physical fitness category, constituting 11.1%. Additionally, 4 students were placed in the good category, accounting for 22.2%. The moderate category comprised 9 students, making up 50%, and 3 students fell into the less category, representing 16.7%. A detailed breakdown of these results is provided in Table 3.

Table 2.
Physical Fitness Pretest Results

Category	Frequency	Percentage
Very good	0	0
Good	0	0
Medium	10	55.6%
Less	6	33.3%
Not at all	2	11.1%

Table 3.
Physical Fitness Posttest Results

Category	Frequency	Percentage
Very good	2	11.1%
Good	4	22.2%
Medium	9	50%
Less	3	16.7%
Not at all	0	0

Upon examining the outcomes of the normality test presented in table 4, the significance value ($p > 0.05$) indicates that the entire dataset follows a normal distribution. Consequently, the analysis proceeds using the t-test or influence test. The t-test results reveal a significance value of 0.000,

which is less than 0.05, signifying a substantial impact on physical fitness. In light of these findings, it can be inferred that modified traditional games have a noteworthy effect on enhancing physical fitness in elementary school students. Further details are provided in table 5.

Table 4.
Shapiro-Wilk Normality Test Results

Physical Fitness	Statistic	df	Sig.
Pretest	0.919	18	0.123
Posttest	0.956	18	0.532

Table 5.
Paired Samples Test

Result	Physical Fitness	Mean	Std. Deviation	t	df	Sig. (2-tailed)
Pair 1	Pretest - Posttest	-2.833	2.176	-5.524	17	0.000

By analyzing the pretest and posttest data, it becomes apparent that there is an enhancement in the students' physical fitness levels, evident from the increased mean scores. In the initial data (pretest), the mean value falls within the poor category at 13.44, whereas in the final data (posttest), the mean value rises to 16.28, classifying in the moderate category. These results are detailed in table 6 and visually represented in figure 1.

Table 6.
Descriptive Statistics of Physical Fitness

Result	N	Range	Minimum	Maximum	Mean	Std. Deviation
Pretest	18	9	8	17	13.44	2.854
Posttest	18	11	11	22	16.28	3.357

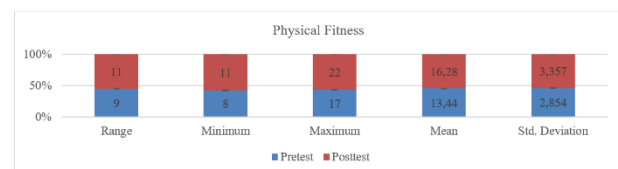


Figure 1. Descriptive Results of Physical Fitness

Discussion

This study aims to see if traditional games in learning can improve physical fitness. The results show that traditional games can improve students' physical fitness. This can be seen from the difference in values that increase from pretest to posttest. In addition, the results also showed a significant increase after being given traditional game treatment. The results of this study are supported by previous research which says that traditional games can improve body skills and balance and build physical fitness (Kusuma et al., 2021). The increase also occurred because traditional games provide opportunities for children to play in groups, the equipment used is simple, contains cultural values, is done with a sense of pleasure without pressure (Suryadi, Nasrulloh, et al., 2024).

Additional research findings also indicate that traditional games serve as an educational element fostering the development of fundamental movement skills (Suherman et al.,

2019). Building upon this foundation, the motion activities incorporated into modified traditional games encompass fundamental movements. The modification of traditional games in line with developmental principles has contributed to an enhancement in students' movement skills (Suryadi, Nasrulloh, et al., 2024). These games are structured in a straightforward manner, ensuring that students can easily engage in and grasp the gameplay. The games are designed not only to improve and cultivate students' motor abilities but also to encourage decision-making during gameplay, achieve and advance the game's objectives, and align with learning principles (Butler & Griffin, 2010).

The findings in this study are to improve physical fitness through traditional games. In addition, traditional games contribute to improving students' movement skills to help students develop movement skills (Harianto et al., 2023). This statement is reinforced by a study revealing that modified traditional games are able to encourage the level of understanding, movement skills, and increase student enjoyment (Gustian, 2021). Many benefits are obtained by students in learning movement skills including recognizing body movements, awareness of the body, awareness of space, quality of motion, and the link between movement abilities and limbs (Abels & Bridges, 2010). Movement skills also improve students' academic achievement because it is influenced by an increase in cognitive abilities (Tandon et al., 2016), and improve fitness, psychological and mental health (Lobstein et al., 2015).

Enhancing physical fitness, commonly known as endurance, can be achieved through well-structured exercises that encompass considerations such as duration, repetition, and intensity to yield positive outcomes (Bompa & Buzzichelli, 2015). Various research findings highlight different approaches to improving physical fitness, including weight training (Zhan & Cui, 2023), triangle running exercise (Telles et al., 2019), interval training (Bo, 2023; Bravo et al., 2008; Faude et al., 2014), running and plyometrics training (Gómez-Molina et al., 2018), and aerobic exercise training (Neiva et al., 2018). These studies suggest that the relationship between physical activity and lung function may contribute to the development of mobility disability through mechanisms beyond the well-known effects on muscle strength (Buchman et al., 2009).

Physical activity refers to body movements generated by the skeletal system that result in increased energy expenditure (Ren et al., 2023). Physical exercise, on the other hand, involves structured activity performed with a specific frequency, aiming to either maintain or enhance various components of an individual's physical fitness, such as muscle strength, flexibility, balance, or cardiovascular endurance (Supriatna et al., 2023). Previous research has indicated that regular physical exercise can postpone the decline of physical function associated with aging, leading to improvements in balance ability, muscle strength, and other functional challenges. These improvements were assessed using indicators such as reduced time for the up-and-down test, higher Berg Balance Scale scores, and increased Fall

Efficacy Scale scores (Liu et al., 2022). However, older adults living alone may encounter difficulties in sustaining physical activity or engaging in traditional sports (Yen & Chiu, 2021).

Conclusion

Traditional games have the potential to enhance the physical fitness of elementary school students, as evidenced by the positive changes observed in students' performance between the pretest and posttest. The improvements are attributed to the adaptation of traditional games to align with the developmental characteristics of students. These games incorporate a playful approach, tailoring activities to fundamental movement skills at the students' developmental stage, thereby capturing their interest. Furthermore, modifications to the games adhere to principles and aspects conducive to the learning experiences of elementary school students. The outcomes contribute valuable insights to the field of physical education for elementary school students. To further enhance research findings, future studies may consider incorporating a control group to evaluate the suitability of different methods for this demographic.

References

- Abels, K. W., & Bridges, J. M. (2010). *Teaching movement education: Foundations for active lifestyles*. Human Kinetics.
- Angulo, J., Assar, M. El, Álvarez-Bustos, A., & Rodríguez-Mañas, L. (2020). Physical activity and exercise: Strategies to manage frailty. *Redox Biology*, 35, 101513. <https://doi.org/10.1016/j.redox.2020.101513>
- Arif, Y. (2020). Identification Of Jasmani Physical Fitness Through (TKJI) Children Age 10-12 Years In Class V Students Of SD Inpres Bertingkat Kelapa Lima 1, 2 And 3 Kupang Cities. *Kinestetik: Jurnal Imiah Pendidikan Jasmani*, 4(2), 18–24. <https://doi.org/10.33369/jk.v4i2.11430>
- Athaya, H., Dewantara, J., Husein, M., Taiar, R., Malek, N. F. A., & Shukla, M. (2023). Analysis of physical fitness in students: a comparative study based on social status. *Tanjungpura Journal of Coaching Research*, 1(3), 71–78. <https://doi.org/10.26418/tajor.v1i3.66542>
- Aziz, I., Okilanda, A., Permadi, A. A., Tjahyanto, T., Prabowo, T. A., Rozi, M. F., Suganda, M. A., & Suryadi, D. (2023). Correlational study: Sports Students' special test results and basic athletic training learning outcomes. *Retos*, 49, 519–524. <https://doi.org/10.47197/retos.v49.98820>
- Aziz, I., Okilanda, A., Rozi, M. F., Suganda, M. A., & Suryadi, D. (2023). Results of Special Tests on Sports Students: Does It Have a Relationship with Learning Outcomes of Basic Athletic Practice? *International Journal of Human Movement and Sports Sciences*, 11(3), 676–682. <https://doi.org/10.13189/saj.2023.110322>
- Baek, K.-W., Jeon, T.-B., Yoo, J.-I., Park, J. S., & Kim, J.-S. (2020). Effects of Exercise on Physical Fitness and

- Strength According to the Frailty Level of Female Elderly with Hypertension. *Exercise Science*, 29(4), 368–376. <https://doi.org/10.15857/ksep.2020.29.4.368>
- Bo, Y. (2023). *Effects of intermittent soccer training on physical endurance in university students*. 29, 1–4.
- Bompa, T., & Buzzichelli, C. (2015). *Periodization training for sports: Human Kinetics Champaign*.
- Bravo, D. F., Impellizzeri, F. M., Rampinini, E., Castagna, C., Bishop, D., & Wisloff, U. (2008). Sprint vs. interval training in football. *Int J Sports Med*, 29(8), 668–674.
- Buchman, A. S., Boyle, P. A., Leurgans, S. E., Evans, D. A., & Bennett, D. A. (2009). Pulmonary Function, Muscle Strength, and Incident Mobility Disability in Elders. *Proceedings of the American Thoracic Societ*. <https://doi.org/10.1513/pats.200905-030RM>
- Butler, J., & Griffin, L. (2010). *More teaching games for understanding: Moving globally*. Human Kinetics.
- Cocca, A., Verdugo, F. E., Cuenca, L. T. R., & Cocca, M. (2020). Effect of a game-based physical education program on physical fitness and mental health in elementary school children. *International Journal of Environmental Research and Public Health*. <https://doi.org/10.3390/ijerph17134883>
- Faude, O., Steffen, A., Kellmann, M., & Meyer, T. (2014). The effect of short-term interval training during the competitive season on physical fitness and signs of fatigue: a crossover trial in high-level youth football players. *Int J Sports Physiol Perform*, 9(6), 936–44.
- Gipit Charles, M. A., Abdullah, M. R., Musa, R. M., Kosni, N. A., & Maliki, A. B. H. M. (2017). The effectiveness of traditional games intervention program in the improvement of form one school-age children's motor skills related performance components. *Journal of Physical Education and Sport*, 17, 925–930. <https://doi.org/10.7752/jpes.2017.s3141>
- Gipit, M. A., Abdullah, M. R., Musa, R. M., Kosni, N. A., & Maliki, A. B. H. M. (2017). The effect of traditional games intervention programme in the enhancement school-age children's motor skills: A preliminary study. *Malaysian Journal of Movement, Health & Exercise*, 6(2), 157–169. <https://doi.org/10.15282/mohe.v6i2.142>
- Gómez-Molina, J., Ogueta-Alday, A., Camara, J., Stickley, C., & García-lópez, J. (2018). Effect of 8 weeks of concurrent plyometric and running training on spatiotemporal and physiological variables of novice runners. *European Journal of Sport Science*, 18(2), 162–169. <https://doi.org/10.1080/17461391.2017.1404133>
- González-Fernández, F. T., González-Víllora, S., Baena-Morales, S., Pastor-Vicedo, J. C., Clemente, F. M., Badicu, G., & Murawska-Ciałowicz, E. (2021). Effect of Physical Exercise Program Based on Active Breaks on Physical Fitness and Vigilance Performance. *Biology*, 10(11), 1151. <https://doi.org/10.3390/biology10111151>
- Goodway, J. D., Ozmun, J. C., & Gallahue, D. L. (2019). *Understanding Motor Development: Infants, Children, Adolescents, Adults* (Eighth Edi). Jones & Bartlett Learning, 5 Wall Street Burlington.
- Gustian, U. (2021). Effectiveness of Traditional Games In Stimulating Elementary School Student Motor Skill Development. *Jurnal Pendidikan Jasmani Dan Olahraga*, 6(1), 75–80. <https://doi.org/10.17509/jpjo.v6i1.27026>
- Haïdara, Y., Okilanda, A., Dewintha, R., & Suryadi, D. (2023). Analysis of students' basic basketball skills: A comparative study of male and female students. *Tanjungpura Journal of Coaching Research*, 1(1), 1–5. <https://doi.org/10.26418/tajor.v1i1.63796>
- Hardinata, R., B, P. S., Okilanda, A., Tjahyanto, T., Prabowo, T. A., Rozi, M. F., Suganda, M. A., & Suryadi, D. (2023). Analysis of the physical condition of soccer athletes through the yo-yo test: a survey study on preparation for the provincial sports week. *Retos*, 50, 1091–1097. <https://doi.org/10.47197/retos.v50.100300>
- Hardinata, R., Gustian, U., & Perdana, R. P. (2021). The Effectiveness of the Triangle Run Exercise Method in Improving Aerobic Resistance Soccer Player. *JUARA : Jurnal Olahraga*, 6(1), 115–124. <https://doi.org/10.33222/juara.v6i1.1180>
- Hardinata, R., Yosika, G. F., Haïdara, Y., Perdana, R. P., Gustian, U., Suryadi, D., Sacko, M., & Abidin, M. Z. (2023). Project Based Learning Model: Can It Improve Dribbling Skills In Soccer Games? *Indonesian Journal of Physical Education and Sport Science*, 3(1), 69–80. <https://doi.org/10.52188/ijpess.v3i1.387>
- Harianto, E., Gustian, U., Supriatna, E., Shalaby, M. N., & Taiar, R. (2023). Stimulating game performance skills in students: experimental studies using net games. *Tanjungpura Journal of Coaching Research*, 1(2), 63–70. <https://doi.org/10.26418/tajor.v1i2.65009>
- Kusuma, I. K. H. W., Asmawi, M., Hernawan, H., Dlis, F., Widiastuti, W., & Kanca, I. N. (2021). A Study of Learning Physical Fitness Activities Based on Traditional Balinese Sports Games for Students' Physical Fitness. *International Journal of Human Movement and Sports Sciences*. <https://doi.org/10.13189/saj.2021.090525>
- Liu, T., Wang, Sun, J., Chen, W., Meng, L., Li, J., Cao, M., Liu, Q., & Chen, C. (2022). The Effects of an Integrated Exercise Intervention on the Attenuation of Frailty in Elderly Nursing Homes: A Cluster Randomized Controlled Trial. *The Journal of Nutrition, Health and Aging*, 26(3), 222–229. <https://doi.org/10.1007/s12603-022-1745-4>
- Lobstein, T., Jackson-Leach, R., Moodie, M. L., Hall, K. D., Gortmaker, S. L., Swinburn, B. A., James, W. P. T., Wang, Y., & McPherson, K. (2015). Child and adolescent obesity: part of a bigger picture. *The Lancet*, 385(9986), 2510–2520. [https://doi.org/10.1016/S0140-6736\(14\)61746-3](https://doi.org/10.1016/S0140-6736(14)61746-3)
- Manchado, C., Cortell-Tormo, J. M., & Tortosa-Martínez, J. (2018). Effects of two different training periodization models on physical and physiological aspects of elite

- female team handball players. *Journal of Strength and Conditioning Research*, 32(1), 280–287. <https://doi.org/10.1519/JSC.0000000000002259>
- Mashud, Arifin, S., Kristiyandaru, A., Samodra, Y. T. J., Santika, I. G. P. N. A., & Suryadi, D. (2023). Integration of project based learning models with interactive multimedia: Innovative efforts to improve student breaststroke swimming skills. *Physical Education of Students*, 27(3), 118–125. <https://doi.org/10.15561/20755279.2023.0304>
- Mashud, M., Arifin, S., Warni, H., Samodra, Y. T. J., Yosika, G. F., Basuki, S., Suryadi, D., & Suyudi, I. (2024). Physical Fitness: Effects of active lifestyle internalization through physical literacy awareness based project. *Retos*, 51, 1299–1308. <https://doi.org/10.47197/retos.v51.101662>
- Mashud, Warni, H., Putra, M. F. P., Haris, M. Al, Samodra, Y. T. J., Tantri, A., Kristiyandaru, A., & Suryadi, D. (2023). Integrating the Project-Based Learning and the Inclusive Teaching Style: An Innovation to Improve Freestyle Swimming Skills. *International Journal of Human Movement and Sports Sciences*, 11(5), 956–964. <https://doi.org/10.13189/saj.2023.110503>
- Merino-Campos, C., & Del Castillo Fernández, H. (2016). The Benefits of Active Video Games for Educational and Physical Activity Approaches: A Systematic Review. *Journal of New Approaches in Educational Research*, 5(2), 115–122. <https://doi.org/10.7821/naer.2016.7.164>
- Neiva, H. P., Fail, L. B., Izquierdo, M., Marques, M. C., & Marinho, D. A. (2018). The effect of 12 weeks of water-aerobics on health status and physical fitness: An ecological approach. *PLoS ONE*. <https://doi.org/10.1371/journal.pone.0198319>
- Perdana, R. P., Supriatna, E., Yanti, N., & Suryadi, D. (2023). Team Game Tournament (TGT)-type cooperative learning model: How does it affect the learning outcomes of football shooting? *Edu Sportivo: Indonesian Journal of Physical Education*, 4(1), 86–96. [https://doi.org/10.25299/es:ijope.2023.vol4\(1\).12130](https://doi.org/10.25299/es:ijope.2023.vol4(1).12130)
- Read, P. J., Oliver, J. L., De Ste Croix, M. B. A., Myer, G. D., & Lloyd, R. S. (2016). Neuromuscular Risk Factors for Knee and Ankle Ligament Injuries in Male Youth Soccer Players. *Sports Medicine*, 46(8), 1059–1066. <https://doi.org/10.1007/s40279-016-0479-z>
- Ren, Y., Lin, C., Zhou, Q., Yingyuan, Z., Wang, G., & Lu, A. (2023). Effectiveness of virtual reality games in improving physical function, balance and reducing falls in balance-impaired older adults: A systematic review and meta-analysis. *Archives of Gerontology and Geriatrics*, 108, 104924. <https://doi.org/10.1016/j.archger.2023.104924>
- Rubiyatno, Perdana, R. P., Fallo, I. S., Arifin, Z., Nusri, A., Suryadi, D., Suganda, M. A., & Fauziah, E. (2023). Analysis of differences in physical fitness levels of extracurricular futsal students: Survey studies on urban and rural environments. *Pedagogy of Physical Culture and Sports*, 27(3), 208–214. <https://doi.org/10.15561/26649837.2023.0304>
- Samodra, Y. T. J., Suryadi, D., Wati, I. D. P., Supriatna, E., Santika, I. G. P. N. A., Suganda, M. A., & Dewi, P. C. P. (2023). Analysis of gross motoric analysis of elementary school students: A comparative study of students in hill and coastal areas. *Pedagogy of Physical Culture and Sports*, 27(2), 139–145. <https://doi.org/10.15561/26649837.2023.0206>
- Suganda, M. A., Soegiyanto, Setyawati, H., Rahayu, S., & Rustiadi, T. (2023). Development of physical fitness tests for early childhood 4–6 years. *Fizjoterapia Polska*, 23(1), 40–49. <https://doi.org/10.56984/8ZG07B6FF>
- Suherman, W. S., Dapan, D., Guntur, G., & Muktiani, N. R. (2019). Development of a traditional children game based instructional model to optimize kindergarteners' fundamental motor skill. *Jurnal Cakrawala Pendidikan*, 38(2), 356–365. <https://doi.org/10.21831/cp.v38i2.25289>
- Supriatna, E., Suryadi, D., Haetam, M., & Yosika, G. F. (2023). Analysis of the Endurance Profile (Vo2max) of Women's Volleyball Athletes: Yo-yo intermittent test level 1. *Indonesian Journal of Physical Education and Sport Science (IJPESS)*, 3(1), 12–19. <https://doi.org/10.52188/ijpess.v3i1.369>
- Suryadi, D., Komaini, A., Suganda, M. A., Rubiyatno, R., Faridah, E., Fauzan, L. A., Fauziah, E., Putra, M. E., & Ayubi, N. (2024). Sports Health in Older Age: Prevalence and Risk Factors - Systematic Review. *Retos*, 53, 390–399. <https://doi.org/10.47197/retos.v53.102654>
- Suryadi, D., Nasrulloh, A., Yanti, N., Ramli, R., Fauzan, L. A., Kushartanti, B. W., Sumaryanti, S., Suhartini, B., Budayati, E. S., Arovah, N. I., Mashud, M., Suganda, M. A., Sumaryanto, S., Sutapa, P., Abdullah, N. M. bin, & Fauziah, E. (2024). Stimulation of motor skills through game models in early childhood and elementary school students: systematic review in Indonesia. *Retos*, 51, 1255–1261. <https://doi.org/10.47197/retos.v51.101743>
- Suryadi, D., Samodra, Y. T. J., Gustian, U., Yosika, G. F., B, P. S., Dewintha, R., & Saputra, E. (2023). Problem-based learning model: Can it improve learning outcomes for long serve in badminton. *Edu Sportivo: Indonesian Journal of Physical Education*, 4(1), 29–36. [https://doi.org/10.25299/es:ijope.2023.vol4\(1\).10987](https://doi.org/10.25299/es:ijope.2023.vol4(1).10987)
- Tandon, P. S., Tovar, A., Jayasuriya, A. T., Welker, E., Schober, D. J., Copeland, K., Dev, D. A., Murriel, A. L., Amso, D., & Ward, D. S. (2016). The relationship between physical activity and diet and young children's cognitive development: A systematic review. *Preventive Medicine Reports*, 3, 379–390. <https://doi.org/10.1016/j.pmedr.2016.04.003>
- Tantri, A., Aprial, B., Mashud, M., Kristiyandaru, A.,

- Basuki, S., Samodra, Y. T. J., Warni, H., Arifin, S., Wati, I. D. P., Thamrin, L., & Suryadi, D. (2023). Modification of interactive multimedia with the ARA MODEL: study of development of football learning models in pandemic times. *Retos*, 50, 1289–1298. <https://doi.org/10.47197/retos.v50.100587>
- Telles, S., Reddy, S. K., & Nagendra, H. R. (2019). A European strategy for low-emission mobility. *Journal of Chemical Information and Modeling*, 53(9), 1689–1699. <https://doi.org/10.1017/CBO9781107415324.004>
- Tettero, O. M., Aronson, T., Wolf, R. J., Nuijten, M. A. H., Hopman, M. T. E., & Janssen, I. M. C. (2018). Increase in physical activity after bariatric surgery demonstrates improvement in weight loss and cardiorespiratory fitness. *Obesity Surgery*, 28(12), 3950–3957. <https://doi.org/10.1007/s11695-018-3439-x>
- Umar, U., Okilanda, A., Suganda, M. A., Mardesia, P., Suryadi, D., Wahyuni, D., Widyastuti, S. R., Samodra, Y. T. J., & Kurniawan, F. (2023). Blended learning and online learning with project-based learning: Do they affect cognition and psycho-motor learning achievement in physical conditions? *Retos*, 50(556–565). <https://doi.org/10.47197/retos.v50.99965>
- Van Eetvelde, H., Mendonça, L. D., Ley, C., Seil, R., & Tischer, T. (2021). Machine learning methods in sport injury prediction and prevention: a systematic review. *Journal of Experimental Orthopaedics*, 8(1). <https://doi.org/10.1186/s40634-021-00346-x>
- Vasileios, A., Athanasios, S., Antonios, S., Nikos, G., & Giorgos, P. (2018). The increase of vo2 max variation and the specific biochemical parameters in soccer players after a pre-season training program. *Journal of Physical Education and Sport*, 18(2), 686–694. <https://doi.org/10.7752/jpes.2018.02100>
- Yen, H.-Y., & Chiu, H.-L. (2021). Virtual Reality Exergames for Improving Older Adults' Cognition and Depression: A Systematic Review and Meta-Analysis of Randomized Control Trials. *Journal of American Medical Directors Association*, 22(5), 995–1002. <https://doi.org/10.1016/j.jamda.2021.03.009>
- Zhan, C., & Cui, P. (2023). Impacts of weight training on physical fitness in table tennis. *Revista Brasileira de Medicina Do Esporte*. https://doi.org/10.1590/1517-8692202329012023_0036

Datos de los autores y traductor:

		Autor/a – Traductor/a
Irvan Septianto	irvanseptianto.2023@student.uny.ac.id	Autor/a
Sumaryanti	sumaryanti@uny.ac.id	Autor/a
Ahmad Nasrulloh	ahmadnasrulloh@uny.ac.id	Autor/a
Sulistiyono	sulistiyono@uny.ac.id	Autor/a
Hartman Nugraha	hanugra09@gmail.com	Autor/a
Masnur Ali	ali.masnur@unj.ac.id	Autor/a
Aria Malik Ramadhani	ariamalik.2021@student.uny.ac.id	Autor/a
Julian Dewantara	juliandewantara.2023@student.uny.ac.id	Autor/a
Nida Haniyyah	nidahaniyyah.2023@student.uny.ac.id	Autor/a
Fauzi	fauzi@uny.ac.id	Autor/a
Didi Suryadi	didisurya1902@gmail.com/didisuryadi.2023@student.uny.ac.id	Autor/a
Roy Ardian	royardian2023@student.uny.ac.id	Autor/a
Subarjo	subarjo@fkip.untan.ac.id	Autor/a