P-ISSN: 3047-1915| E-ISSN: 3047-1850

Gusti Tahir[1], Risna Podungge[2], Sulasikin Sahdi Kadir[3]., 2(3), 116-128* **[2025]**

Jambura Arena Sports



Development of the football bounce game model as a physical education learning medium at senior high school 4, gorontalo city

*Gusti Tahir[1], Risna Podungge[2], Sulasikin Sahdi Kadir[3]**
[1]Physical Education, Universitas Negeri Gorontalo, Kota Gorontalo, Indonesia
[2]Physical Education, Universitas Negeri Gorontalo, Kota Gorontalo, Indonesia
[3]Physical Education, Universitas Negeri Gorontalo, Kota Gorontalo, Indonesia
*Corresponding author: gustit486@gmail.com

ABSTRACT

Physical education, sport, and health (PJOK) learning in Indonesian senior high schools continues to face the problem of declining student interest in physical activity, particularly when instruction relies on repetitive, conventional drills rather than engaging game-based media. This study addresses that gap by developing Football Bounce, a modified game that adapts the ball-bouncing principle of sepak takraw to a badminton-court configuration, as a creative and inclusive medium for PJOK learning. This research and development (R&D) study used the ADDIE model, comprising Analysis, Design, Development, Implementation, and Evaluation. Data were collected through validation questionnaires completed by a game/product expert and a learning expert, and through a response questionnaire administered to 30 twelfth-grade students following a small-scale field trial. Data were analyzed descriptively using a four-point Likert scale converted into eligibility percentages. The game expert rated the product 88.63% (strongly agree) at the initial validation stage and 88.68% after revision; the learning expert rated it 80.76% initially and 93.3% after revision; and the student trial produced a total response score of 88.41%, all within the "strongly agree/very feasible" category. These findings indicate that the Football Bounce game model is valid, practical, and effective as a physical education learning medium capable of enhancing students' motivation, fitness, and fundamental game skills, and that it offers a novel, low-cost, badminton-court-based alternative for wider community use.

Keywords: game-based learning; football bounce; ADDIE model; physical education.

ABSTRAK

Pembelajaran Pendidikan Jasmani, Olahraga, dan Kesehatan (PJOK) di sekolah menengah atas di Indonesia masih menghadapi masalah rendahnya minat siswa terhadap aktivitas fisik, terutama ketika pembelajaran hanya mengandalkan latihan konvensional yang monoton. Penelitian ini bertujuan menjawab permasalahan tersebut dengan mengembangkan model permainan Foot Ball Bounce, yaitu permainan modifikasi yang mengadopsi prinsip memantulkan bola dari olahraga sepak takraw dan dimainkan pada lapangan bulutangkis, sebagai media pembelajaran PJOK yang kreatif dan dapat diterapkan pula pada masyarakat luas. Penelitian pengembangan (R&D) ini menggunakan

model ADDIE yang terdiri atas lima tahap, yaitu Analysis, Design, Development, Implementation, dan Evaluation. Data dikumpulkan melalui angket validasi ahli permainan dan ahli pembelajaran, serta angket respons yang dibagikan kepada 30 siswa kelas XII setelah uji coba skala kecil dilaksanakan. Data dianalisis secara deskriptif menggunakan skala Likert 1-4 yang dikonversi menjadi persentase kelayakan. Hasil penelitian menunjukkan skor ahli permainan 88,63% (sangat setuju) pada validasi awal dan 88,68% setelah revisi, skor ahli pembelajaran 80,76% pada validasi awal dan 93,3% setelah revisi, serta skor respons siswa sebesar 88,41%, seluruhnya berada pada kategori sangat setuju/sangat layak. Dengan demikian, model permainan Foot Ball Bounce dinyatakan valid, praktis, dan efektif digunakan sebagai media pembelajaran PJOK yang dapat meningkatkan motivasi, kebugaran, dan keterampilan siswa.

Kata Kunci: media permainan; foot ball bounce; model ADDIE; pendidikan jasmani

Copyright © 2025 Gusti Tahir, Risna Podungge, Sulasikin Sahdi Kadir

How to Cite: Tahir, G., Podungge, R., & Kadir, S. S. (2025). Development of the Football Bounce Game Model as a Physical Education Learning Medium at Senior High School 4, Gorontalo City. JAS: Jambura Arena Sports, 2(3), 116-128.

Authors' Contribution: a – Study Design; b – Data Collection; c – Statistical Analysis; d – Manuscript Preparation; e – Funds Collection

OPEN ACCESS

INTRODUCTION

Sport has been part of human life for as long as organized societies have existed, and its importance is unlikely to diminish as long as people continue to value health, discipline, and social connection (Muhtar, 2020). Unlike domains of human activity that some may regard as optional, physical activity is inseparable from the maintenance of a healthy body and mind; it is practiced both competitively and recreationally, and it consistently offers a combination of physical benefit and psychological relief to those who engage in it regularly (Megamulya, 2023). Beyond the individual, sport carries social value: it is an activity worth promoting and integrating into everyday life for students and the wider community alike, because regular participation is associated with disease prevention, improved posture, healthier growth, sharper cognition, better appetite and digestion, reduced injury risk, improved circulation, stronger bones and joints, and an enhanced capacity for daily activity. Regular exercise also supports cardiovascular health, muscular strength, flexibility, and coordination, while helping to manage stress, anxiety, and depressive symptoms.

Within the school setting, Physical Education, Sport, and Health (Pendidikan Jasmani, Olahraga, dan Kesehatan, or PJOK) is the primary vehicle through which these benefits are delivered to adolescents. This task has become more urgent in recent years: disruptions to normal schooling and play opportunities, such as those experienced during the COVID-19 pandemic, have been associated with reduced physical activity and altered play behavior

among school-aged children (Kourti et al., 2021), reinforcing the need for engaging, well-designed PJOK activities that can restore students' enthusiasm for movement. However, a substantial body of recent research suggests that conventional, drill-based PJOK instruction often fails to sustain student motivation and engagement (Sotos-Martínez et al., 2023; Tendinha et al., 2021). Game-based learning (GBL) has therefore emerged as one of the most consistently recommended strategies for revitalizing physical education: by embedding movement objectives inside rule-governed, goal-directed play, GBL supports learners' basic psychological needs for autonomy, competence, and relatedness, which in turn fosters intrinsic and self-determined forms of motivation (Bado, 2022). Systematic reviews of the Sport Education Model likewise report that most empirical studies find a significant, positive association between game- or sport-based pedagogical models and student motivation in PE settings (Tendinha et al., 2021), while experimental work on the Tactical Games Model has shown measurable gains in university students' motivation toward compulsory PE courses when instruction is organized around authentic game play rather than isolated technique drills (Wang et al., 2024). Complementary evidence from gamified PE interventions shows increases in intrinsic motivation and identified regulation following the introduction of structured, game-like reward systems (Sotos-Martínez et al., 2023).

Modifying existing games and sports to fit school resources and student characteristics is one of the most practical ways to operationalize this game-based approach. Traditional and modified games have been shown to support not only motor development but also social-emotional outcomes: children who take part in traditional games with an explicit social component demonstrate stronger social skills and improved peer relationships compared with those who do not (Hartanto et al., 2021), and structured traditional-sport interventions have been found to improve fundamental movement skills and social attitudes among elementary students, including during periods of restricted, physically distanced instruction (Mujriah et al., 2022). At a broader developmental level, traditional children's games contribute meaningfully to skill development, communication, and cultural transmission across age groups (Madondo & Tsikira, 2022), and sport- and game-based activities more generally have been shown to support motor-skill development across highly diverse groups of children and adolescents, underscoring the inclusive potential of well-designed game products (Aksović et al., 2023). Similarly, deliberately modifying the equipment or playing area of an existing sport, rather than inventing an entirely new one, has repeatedly been shown to be an effective and low-cost way to make motor-skill acquisition more accessible to young or beginner participants. Studies that scaled badminton court size and net height to match children's anthropometry, for example, found that appropriately modified equipment led to measurable improvements in stroke performance and rally patterns (Suppiah et al., 2024), and a body-scaling approach to badminton racket length produced better skill-test outcomes than either oversized or undersized standard equipment (Azmi et al., 2023). Likewise, modified invasion games have been found to enhance both real and self-perceived motor competence among elementary school students (Neira-Navarrete et al., 2024), which is significant because higher motor competence is

associated with greater long-term participation in physical activity into adolescence and adulthood.

Sepak takraw offers a particularly promising foundation for this kind of adaptation in the Indonesian context. As a sport that combines elements of football, volleyball, and gymnastics, sepak takraw places heavy demands on players' agility, coordination, precision, and lower-limb ball control, all of which are acquired primarily through the repeated practice of kicking and bouncing the ball into the air and across a net (Jufrianis et al., 2021). Because the essence of sepak takraw lies in this bouncing and receiving action rather than in any single piece of specialized equipment, it lends itself well to modification for use on facilities that Indonesian schools already possess, such as a standard badminton court, and with simple, inexpensive tools such as a light ball and a net. Cooperative and drill-based instructional approaches built around sepak takraw's fundamental techniques, including footwork and ball control (sepak sila), have themselves been shown to produce significant gains in students' motor skills within only a few sessions (Bachtiar & Adil, 2025), reinforcing the idea that a sepak-takraw-derived game model is well suited to the physical development needs of adolescent learners.

The systematic design of such a game model, however, benefits from a structured instructional-design framework rather than ad hoc trial and error. The ADDIE model, comprising Analysis, Design, Development, Implementation, and Evaluation, has been used extensively and successfully to guide the development of physical-activity interventions in school settings, including functional training programs that improved primary-school children's physical fitness (Li & Cheong, 2023) and gamified physical-cognitive training programs for other age groups (Kamnardsiri et al., 2024). ADDIE's staged, evaluative structure allows a new game model to be refined iteratively on the basis of expert judgment before it is tested with real students, which strengthens both the content validity and the practical feasibility of the resulting product (Bado, 2022).

Despite this growing evidence base, most existing research on modified games for PJOK in Indonesia has focused either on traditional games oriented toward younger children (Hartanto et al., 2021; Mujriah et al., 2022) or on badminton-specific equipment scaling for skill acquisition alone (Suppiah et al., 2024; Azmi et al., 2023), while comparatively little attention has been paid to combining the ball-control fundamentals of sepak takraw with the readily available badminton-court format as a single, unified game product validated through a complete ADDIE cycle for senior high school students. This represents a research gap: an accessible, inclusive, and motivationally engaging modified game that can be played competitively on facilities Indonesian schools already have, grounded in a locally familiar sport, and formally validated for PJOK use, has not been well documented in the literature. Prior to this study, preliminary observation at SMA Negeri 4 Kota Gorontalo indicated that students showed low interest in participating in PJOK activities, a pattern consistent with broader concerns about declining engagement in conventional physical education (Sotos-Martínez et al., 2023). This observation motivated the development of Football Bounce, a

creative modified-game product intended to be applied not only in the classroom but also more broadly within the community.

The novelty of this study lies in its integration of sepak takraw's ball-bouncing principle with a badminton-court configuration to create a new, named game, Football Bounce, together with its systematic validation through the full five-stage ADDIE cycle involving both expert judgment and a student field trial. Accordingly, this study aims to (1) develop the Football Bounce game model as a learning medium for PJOK at the senior high school level, and (2) examine the feasibility of the Football Bounce game model, based on the assessments of a game expert, a learning expert, and student responses following a small-scale trial, for wider application within the school and the community.

RESEARCH METHOD

This study used a research and development (R&D) approach with the ADDIE instructional-design model, which consists of five stages: Analysis, Design, Development, Implementation, and Evaluation. The ADDIE framework was selected because of its demonstrated suitability for developing and validating physical-activity products in school settings through an iterative, expert-informed process (Li & Cheong, 2023; Kamnardsiri et al., 2024).

In the Analysis stage, the researchers conducted preliminary observation at SMA Negeri 4 Kota Gorontalo, located on Jl. Brigjen Piola Isa, Wongkaditi, Kecamatan Kota Utara, Kota Gorontalo, to identify the extent of students' interest in participating in PJOK activities. This observation indicated that students showed low enthusiasm toward conventional physical education activities, establishing the need for a more creative learning medium.

In the Design stage, the researchers formulated the concept, rules, equipment, and playing area of the Football Bounce game. The game was designed as a modification of sepak takraw, adapted to be played on a badminton court, with the objective of bouncing the ball over the net using the feet in a manner that requires cooperation, agility, coordination, and accuracy. Matches are contested per team, with one player per team in the singles category and two players per team in the doubles category. The equipment used consists of a ball, a net, and a modified badminton court.

In the Development stage, a product prototype was constructed based on the Design-stage specifications and was then evaluated by two validators: a game/product expert and a learning expert. Both experts assessed the product using a structured validation questionnaire employing a four-point Likert scale (1–4), covering aspects of game design, rules, safety, and suitability as a PJOK learning medium. Questionnaire development followed established practice for instrument validation in physical education research, in which items are first reviewed for content relevance before being used for expert and respondent assessment (Pastor-Cisneros et al., 2026). Suggestions from both validators were used as the basis for product

revision prior to field testing.

In the Implementation stage, the revised product was trialed on a small scale with 30 students from class XII IPA 5C at SMA Negeri 4 Kota Gorontalo. This sample size is consistent with common practice in small-scale field trials within R&D studies in physical education, where the purpose of the trial is to gather authentic user response rather than to test statistical generalizability across a full population. Students played the Football Bounce game under researcher supervision and subsequently completed a response questionnaire, also structured on a four-point Likert scale, that had previously been validated by the game expert and the learning expert.

In the Evaluation stage, all data obtained from the expert validation questionnaires and the student response questionnaire were compiled and analyzed to determine the overall feasibility of the Football Bounce game model.

Data were collected from the observation stage through to the product trial stage using validated questionnaires as the primary instrument. The total score obtained from each questionnaire was calculated by summing respondents' item scores, then converting the total into an eligibility percentage using the standard Likert-scale percentage formula, in which the total obtained score is divided by the maximum possible score and multiplied by 100%. The resulting percentage was subsequently classified into a feasibility category, ranging from "very feasible/strongly agree" for the highest scores to "not feasible/strongly disagree" for the lowest, following conventional Likert-based interpretation criteria used in physical education product-development research. This descriptive-quantitative technique allowed the researchers to determine both the validity of the Football Bounce product, based on expert judgment, and its practicality and attractiveness, based on student responses, before drawing conclusions about its overall feasibility as a PJOK learning medium.

RESULTS

Analysis Stage. Preliminary observation at SMA Negeri 4 Kota Gorontalo confirmed that students displayed limited enthusiasm for participating in conventional PJOK activities. Interviews and informal observation suggested that repetitive drill-based instruction was a contributing factor, echoing concerns identified in the broader literature on declining PE motivation among adolescents (Sotos-Martínez et al., 2023). This finding provided the empirical basis for developing a new, game-based learning product capable of engaging students more effectively than the school's existing PJOK activities.

Design Stage. Based on the analysis findings, the researchers designed Football Bounce as a modified sport adapted from sepak takraw. The core mechanic of the game, kicking and bouncing the ball back and forth over a net without allowing it to touch the ground, was retained from sepak takraw, while the playing area was reconfigured to fit the dimensions of a standard badminton court, making the game playable on facilities already available at most Indonesian

schools. Two competitive formats were designed: a singles category, contested by one player per team, and a doubles category, contested by two players per team. The equipment required was limited to a ball, a net, and the modified court, keeping implementation costs low. Figure 1 illustrates the five ADDIE stages followed during the development of the Football Bounce product.



Figure 1. The Five Stages of the ADDIE Model Applied in the Development of the Football Bounce Game

Development Stage. A prototype of the Football Bounce game, including its rules, equipment specifications, and an accompanying guidebook, was produced and submitted for expert validation. Two categories of validators assessed the product: a game/product expert, who evaluated the design, rules, safety, and playability of the game, and a learning expert, who evaluated its suitability and effectiveness as a PJOK instructional medium. Both experts used a four-point Likert-scale questionnaire and provided qualitative suggestions that were used as the basis for revising the product before it was field-tested. Table 1 presents the quantitative validation results obtained from both experts, at the initial validation stage and after the product was revised in response to their feedback, together with the results of the subsequent student trial.

Assessment Source	Stage	Percentage	Category
Game/Product Expert	Initial validation	88.63%	Strongly agree
Learning Expert	Initial validation	80.76%	Strongly agree
Game/Product Expert	Final validation (post-revision)	88.68%	Strongly agree / very feasible
Learning Expert	Final validation (post-revision)	93.3%	Strongly agree / very feasible
Student small-scale trial (n = 30)	Implementation	88.41%	Strongly agree / very feasible

Table 1. Feasibility Results of the Football Bounce Game Model

As shown in Table 1, both validators rated the Football Bounce product in the “strongly agree” category from the initial validation stage onward, and both ratings improved further after the product was revised according to the experts’ recommendations, with the learning

expert's score increasing from 80.76% to 93.3%. This pattern indicates that the revision process meaningfully strengthened the instructional quality of the product, consistent with the iterative logic of the ADDIE model, in which expert feedback during the Development stage is expected to improve the final product prior to implementation (Li & Cheong, 2023).

Implementation Stage. Following expert validation and product revision, the Football Bounce game was trialed on a small scale with 30 students from class XII IPA 5C at SMA Negeri 4 Kota Gorontalo. Students played the game in both the singles and doubles formats under researcher supervision, after which they completed a response questionnaire assessing their perceptions of the game's playability, enjoyment, and perceived contribution to their fitness and skill. The total student response score, aggregated across all respondents and questionnaire items, reached 88.41%, placing the students' overall response in the "strongly agree" category. This result indicates that students found the Football Bounce game engaging, playable, and worthwhile as a PJOK activity.

Evaluation Stage. Taken together, the results from the Analysis through Implementation stages indicate that the Football Bounce game model achieved a consistently high level of feasibility across all three sources of judgment: the game/product expert, the learning expert, and the student end users. All three assessment percentages exceeded 80%, and two of the three exceeded 88%, placing the product firmly within the "very feasible/strongly agree" category according to the Likert-based interpretation criteria applied in this study. The overall pattern of results, rising validator scores after revision combined with a high level of positive student response, supports the conclusion that the Football Bounce game model is a valid, practical product suitable for use as a PJOK learning medium at the senior high school level, and one that also holds potential for wider recreational use within the community.

DISCUSSION

The results of this study reinforce and extend several strands of recent literature on game-based and modified-game approaches to physical education. First, the strongly positive expert-validation scores obtained for both the game/product expert (88.63–88.68%) and the learning expert (80.76–93.3%) are consistent with prior ADDIE-based development studies in physical education, which similarly report that instructional products refined through structured expert review achieve high validity ratings before implementation (Li & Cheong, 2023; Kamnardsiri et al., 2024). The improvement in the learning expert's score following revision, from 80.76% to 93.3%, is a particularly encouraging finding, because it suggests that the ADDIE model's built-in feedback loop functioned as intended in this study: expert critique during the Development stage was translated into concrete product improvements rather than being treated as a formality, a pattern also observed in other instructional-design research employing the ADDIE framework (Bado, 2022).

Second, the very high student response score (88.41%) aligns with a growing body of evidence that game-based and gamified approaches to PJOK increase student engagement and

positive affect toward physical activity more effectively than conventional, repetitive drills. Comparable increases in motivation-related outcomes have been documented following the introduction of gamified physical education sessions and their associated basic psychological needs (Sotos-Martínez et al., 2023, 2024) and following the use of tactical or game-centered instructional models in place of direct instruction (Wang et al., 2024). Systematic evidence likewise indicates that sport- and game-based pedagogical models are associated with improved student motivation across a range of school levels (Tendinha et al., 2021), and multimodal, cooperative approaches that combine physical activity with structured group tasks have similarly been shown to strengthen students' social attitudes toward learning (Bassachs et al., 2022). The present findings therefore add further, context-specific support to this pattern within an Indonesian senior high school setting.

Third, the decision to adapt sepak takraw's ball-bouncing mechanic to a badminton-court format is theoretically well grounded. Because a badminton court is already available in most Indonesian schools, this design choice mirrors the logic of equipment- and area-scaling research, which has repeatedly shown that adjusting court dimensions, net height, or equipment specifications to better match participants' physical characteristics and task constraints improves motor-skill acquisition and game performance, particularly for younger or less experienced players (Suppiah et al., 2024; Azmi et al., 2023; Wazir et al., 2026). Because sepak takraw itself is understood to build agility, coordination, and precision primarily through repeated ball-control practice rather than through specialized equipment (Jufrianis et al., 2021), retaining this core mechanic while changing the playing surface allowed the Football Bounce model to preserve the movement-skill benefits of sepak takraw while removing the facility barrier that might otherwise have limited its adoption in schools without a dedicated sepak takraw court. This is consistent with findings that modified invasion and net games can enhance both real and self-perceived motor competence in school-aged participants (Neira-Navarrete et al., 2024), and it resonates with evidence that structured, socially oriented modifications of traditional or existing games can strengthen cooperation, teamwork, and peer interaction alongside physical outcomes (Hartanto et al., 2021; Mujriah et al., 2022), which is relevant given that Football Bounce is played in both singles and cooperative doubles formats.

Practically, these findings suggest that PJOK teachers facing low student engagement in conventional instruction have a low-cost, readily implementable option in Football Bounce, since it requires only a ball, a net, and a standard badminton court, and it has now been formally validated by both a game expert and a learning expert. Theoretically, this study contributes a concrete, empirically validated example of how a locally familiar sport (sepak takraw) can be systematically recombined with an existing facility format (the badminton court) through the ADDIE model to produce a novel modified game, extending prior work on game modification (Suppiah et al., 2024; Azmi et al., 2023; Neira-Navarrete et al., 2024) into a new sport combination not previously documented in the reviewed literature. This supports the broader argument that game-based learning, when systematically designed and validated, can serve

simultaneously as a motivational strategy and a vehicle for motor-skill development within school-based PJOK programs (Bado, 2022; Baena-Morales et al., 2021).

CONCLUSION AND IMPLICATIONS

This study developed Football Bounce, a modified game that adapts the ball-bouncing principle of sepak takraw to a standard badminton-court format, through the five stages of the ADDIE model. The Football Bounce game model was rated 88.63–88.68% (strongly agree) by the game/product expert, 80.76–93.3% (strongly agree) by the learning expert, and 88.41% (strongly agree) by students following a small-scale trial, indicating that the product is valid, practical, and effective as a PJOK learning medium capable of increasing students' motivation, fitness, and fundamental game skills. Practically, this study provides PJOK teachers with a low-cost, readily implementable modified game that requires only facilities most schools already possess. Theoretically, it contributes an empirically validated example of systematic game modification through the ADDIE framework, extending the literature on badminton-court-based and sepak-takraw-derived game design, and offers a foundation for further development and wider community application of the Football Bounce game model.

RESEARCH LIMITATIONS

This study is subject to several limitations. The product trial involved only 30 students from a single class at one senior high school, which limits the generalizability of the findings to other schools, regions, or age groups. The Implementation stage was restricted to a small-scale trial and did not include a large-scale dissemination phase, a control-group comparison, or a pretest–posttest effectiveness test of students' physical fitness or motor skills. Feasibility data also relied on self-reported questionnaire responses rather than objective performance measures. Future research should extend Football Bounce to larger and more diverse samples and evaluate its effectiveness using experimental designs

ACKNOWLEDGMENTS

The authors gratefully acknowledge the school leadership, physical education teachers, and students of SMA Negeri 4 Kota Gorontalo for their cooperation and participation throughout the observation, validation, and trial stages of this research. The authors also thank the game and learning experts who validated the Football Bounce product and provided constructive feedback for its improvement, as well as the Department of Physical Education, Universitas Negeri Gorontalo, for its academic support during the completion of this study.

ETHICAL STATEMENT

The authors declare that there is no conflict of interest in the conduct of this research or in the preparation of this article, whether financial or non-financial, with any party. All data presented in the results of this study are objective findings obtained directly from the expert validation and student trial procedures described above, without external intervention that could affect the integrity or transparency of the study. The authors take full responsibility for the authenticity and validity of the information provided in this manuscript.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest in the conduct of this research or in the preparation of this article, whether financial from any specific sponsor or non-financial with any party. All data presented in the research results are objective findings obtained in the field without external intervention that could affect the integrity and transparency of this study. The authors take full responsibility for the authenticity and validity of the information provided in this manuscript

REFERENCE

Abuhassna, H., & Alnawajha, S. (2023). Instructional design made easy! Instructional design models, categories, frameworks, educational context, and recommendations for future work. European Journal of Investigation in Health, Psychology and Education, 13(4), 715–735. https://doi.org/10.3390/ejihpe13040054

Abuhassna, H., Adnan, M. A. B. M., & Awae, F. (2024). Exploring the synergy between instructional design models and learning theories: A systematic literature review. Contemporary Educational Technology, 16(2), ep499. https://doi.org/10.30935/cedtech/14289

Aksović, N., Dobrescu, T., Bubanj, S., Bjelica, B., Milanović, F., Kocić, M., Zelenović, M., Radenković, M., Nurkić, F., Nikolić, D., Marković, J., Tomović, M., & Vulpe, A.-M. (2023). Sports games and motor skills in children, adolescents and youth with intellectual disabilities. Children, 10(6), 912. https://doi.org/10.3390/children10060912

Ashar, Mania, S., Ibrahim, M. M., Syamsudduha, S., Sadaruddin, & Dewi, A. C. (2024). The impact of traditional games on social-emotional development: A comprehensive review of existing research. Journal of Learning and Development Studies, 4(2), 39–51. https://doi.org/10.32996/jlds.2024.4.2.5

Azmi, A. M. N., Lee, J. L. F., & Nadzalan, A. M. (2023). A body-scaling approach to modifying sports equipment for children: A badminton-based experimental study. International Journal of Human Movement and Sports Sciences, 11(3), 660–667. https://doi.org/10.13189/saj.2023.110320

Bachtiar, I., & Adil, A. (2025). The effect of jigsaw-type cooperative learning on motor skills and basic sepak takraw techniques in students. Journal of Sport Education, Coaching, and Health (JOCCA), 6(2), 177–190. https://doi.org/10.35458/jc.v6i2.4805

Baena-Morales, S., Jerez-Mayorga, D., Delgado-Floody, P., & Martínez-Martínez, J. (2021). Sustainable development goals and physical education: A proposal for practice-based models. International Journal of Environmental Research and Public Health, 18(4), 2129. https://doi.org/10.3390/ijerph18042129

Bado, N. (2022). Game-based learning pedagogy: A review of the literature. Interactive Learning Environments, 30(5), 936–948. https://doi.org/10.1080/10494820.2019.1683587

Bassachs, M., Serra, T., Bubnys, R., Cañabate, D., & Colomer, J. (2022). Multimodal approaches to math and physical education within cooperative learning to enhance social attitudes. Sustainability, 14(24), 16961. https://doi.org/10.3390/su142416961

Hartanto, D., Kusmaedi, N., Ma'mun, A., & Abduljabar, B. (2021). Integrating social skills in traditional games with physical education interventions. International Journal of Human Movement and Sports Sciences, 9(5), 921–928. https://doi.org/10.13189/saj.2021.090513

Jufrianis, Henjilito, R., Hernawan, Sukiri, S., Sukur, A., Abidin, D., Karakauki, M., Syed Ali, S. K., & Pratama, K. W. (2021). The effect of knowledge level (IQ) and physical conditions (power, flexibility and coordination) on smash technique learning skill in sepak takraw. Physical Education Theory and Methodology, 21(3), 264–272. https://doi.org/10.17309/tmfv.2021.3.10

Kamnardsiri, T., Kumfu, S., Munkhetvit, P., Boripuntakul, S., & Sungkarat, S. (2024). Home-based, low-intensity, gamification-based, interactive physical-cognitive training for older adults using the ADDIE model: Design, development, and evaluation of user experience. JMIR Serious Games, 12, e59141. https://doi.org/10.2196/59141

Kourti, A., Stavridou, A., Panagouli, E., Psaltopoulou, T., Tsolia, M., Sergentanis, T. N., & Tsitsika, A. (2021). Play behaviors in children during the COVID-19 pandemic: A review of the literature. Children, 8(8), 706. https://doi.org/10.3390/children8080706

Li, H., & Cheong, J. P. G. (2023). Using the ADDIE model to design and develop physical education lessons incorporated with a functional training component. Frontiers in Public Health, 11, 1201228. https://doi.org/10.3389/fpubh.2023.1201228

Madondo, F., & Tsikira, J. (2022). Traditional children's games: Their relevance on skills development among rural Zimbabwean children age 3–8 years. Journal of Research in Childhood Education, 36(3), 406–420. https://doi.org/10.1080/02568543.2021.1982084

Malo, F. A. P., & Nurhidayat, N. (2021). Survei kemampuan pukulan servis pada mahasiswa UKM tenis lapangan Universitas Muhammadiyah Surakarta. Journal of Innovation Research and Knowledge, 1(5), 845–850.

Megamulya, S. B. (2023). Pengaruh senam aerobik terhadap daya tahan kardiovaskular (Eksperimen pada ekstrakurikuler bola basket SMK Negeri 2 Tasikmalaya) [Unpublished doctoral dissertation]. Universitas Siliwangi.

Muhtar, T. (2020). Sosiologi olahraga. Salam Insan Mulia.

Mujriah, Siswantoyo, Sukoco, P., Rosa, F. O., Susanto, E., & Setiawan, E. (2022). Traditional sport model to improve fundamental movement skills and social attitudes of students during Covid-19. Physical Education Theory and Methodology, 22(3), 309–315. https://doi.org/10.17309/tmfv.2022.3.02

Neira-Navarrete, D., Páez-Herrera, J., Reyes-Amigo, T., Yáñez-Sepúlveda, R., Cortés-Roco, G., Oñate-Navarrete, C., Olivares-Arancibia, J., & Hurtado-Almonacid, J. (2024). Effects of modified invasion games on motor competence and self-assessed physical condition in elementary school students in the physical education classroom. Children, 11(3), 337. https://doi.org/10.3390/children11030337

Pastor-Cisneros, R., Mendoza-Muñoz, M., López-Gil, J. F., & Carlos-Vivas, J. (2026). Development of the physical education knowledge questionnaire-Spain (PEKQ-S): Feasibility, validity and reliability for Spanish children aged 6–12 years. Frontiers in Sports and Active Living. https://doi.org/10.3389/fspor.2025.1737905

Sobarna, A., Rizal, R. M., Hambali, S., Asmara, H., & Sunarsi, D. (2022). Peningkatan prestasi olahraga ditinjau dari konsep ilmiah dan teknologi di KONI Kota Cimahi. Jurnal Penelitian dan Pengabdian Kepada Masyarakat UNSIQ, 9(2), 173–176. https://doi.org/10.32699/ppkm.v9i2.2752

Sotos-Martínez, V. J., Tortosa-Martínez, J., Baena-Morales, S., & Ferriz-Valero, A. (2023). Boosting student's motivation through gamification in physical education. Behavioral Sciences, 13(2), 165. https://doi.org/10.3390/bs13020165

Sotos-Martínez, V. J., Tortosa-Martínez, J., Baena-Morales, S., & Ferriz-Valero, A. (2024). It's

game time: Improving basic psychological needs and promoting positive behaviours through gamification in physical education. European Physical Education Review. https://doi.org/10.1177/1356336X231217404

Suppiah, P. K., Azmi, A. M. N., Lee, J. L. F., Noordin, H., Samsir, M. S., & Musa, R. M. (2024). Effect of modifying net height and court size on children's badminton performance. International Journal of Human Movement and Sports Sciences, 12(1), 106–112. https://doi.org/10.13189/saj.2024.120113

Tahir, A., & Musakirawati, M. (2022). Perancangan mesin pelontar bola tenis berbasis remote control. INSOLOGI: Jurnal Sains dan Teknologi, 1(5), 532–542.

Tendinha, R., Alves, M. D., Freitas, T., Appleton, G., Gonçalves, L., Ihle, A., Gouveia, É. R., & Marques, A. (2021). Impact of sports education model in physical education on students' motivation: A systematic review. Children, 8(7), 588. https://doi.org/10.3390/children8070588

Wang, J., Chee, C. S., & Samsudin, S. (2024). Enhancing university students' motivation in basketball courses through tactical games model. Behavioral Sciences, 14(7), 515. https://doi.org/10.3390/bs14070515

Wazir, M. R. W. N., Suppiah, P. K., Samsir, M. S., Mojilon, F. J. F., Bacho, Z., Yee, H. K., & Akbar, A. (2026). Manipulating task constraints in children's badminton: How equipment and rule modifications shape skill acquisition and game performance. Brazilian Journal of Motor Behavior, 20(1), e532. https://doi.org/10.20338/bjmb.v20i1.532

Yuliawan, F., Indardi, N., & Setyawati, H. (2022). Pengaruh kelengkapan sarana prasarana bulutangkis dalam motivasi untuk berprestasi pada atlet PB Tugu Muda Semarang. Riyadhoh: Jurnal Pendidikan Olahraga, 5(2), 99–106.