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Digitization of Technology in the Educational Physical Activity Model (AFIKSED) Based on Local Wisdom for Junior High School Physical Education Learning

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ABSTRACT

Physical activity is a crucial component in supporting the physical growth and character development of junior high school students, contributing to the creation of a "Golden Generation" of Indonesia. However, the shift in local wisdom values due to societal changes has negatively affected students' engagement in physical activity. According to the National Sports Development Index, 77.12% of children aged 10-15 years fall into the low or very low physical fitness category, primarily due to insufficient physical activity and limited instructional media in Physical Education (PE) classes. This study aimed to develop and evaluate the feasibility of an innovative Educational Physical Activity (Afiksed) model, grounded in local wisdom and integrated with digital technology via an Android application. The application comprises four main menus: physical activity simulations, PE and local culture materials, learning reflection, and interactive quizzes. The study employed a Research and Development (R&D) approach through the Define, Design, and Develop stages. Needs analysis revealed that students exhibited good activeness and motor skills, yet technology use in learning remained low, while teachers required a learning model that is both varied and culturally grounded. Expert validation indicated very high feasibility across learning content (92%), basic movement skills (90%), and digital learning media (88%), with an overall validity of 90%, categorized as Very Valid. These findings indicate that the mobile-based Afiksed model is feasible for implementation and ready for field trials to evaluate its effectiveness in improving physical education learning in junior high schools. This study contributes to the field by providing a culturally relevant, technology-enhanced PE learning model that promotes student engagement, physical fitness, and learning outcomes.

Key words: Physical activity; education; local wisdom; mobile learning; physical education.

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INTRODUCTION

Physical activity is recommended by the World Health Organization for children and adolescents to engage in at least 60 minutes of activity per day in order to achieve and maintain good physical fitness (Kamijo et. al., 2019; Guthold et. al., 2020). However, among junior high school students aged 12-17 years, it shows that 81% Adolescents are not sufficiently physically active, which is a concern given the numerous physical, cognitive, and socio-emotional benefits associated with physical activity for students (Vanderloo et al., 2025; Chen et al., 2020; Yoo et al., 2024; Miyawaki et al., 2019). This can be supported by engaging in well-structured physical activities that help develop kinesthetic and social skills, serving as an essential foundation for facing modern learning

challenges in alignment with the goals of physical education (Syaflin et al., 2021; Lanos, Handayani et. al., 2023).

At the junior high school level, the development of physical activities is based on fundamental movement skills, including locomotor, non-locomotor, and manipulative movements such as running, jumping, throwing, catching, and kicking, which serve as a strong foundation for sports performance and physical competence (Hulteen et al., 2020). Physical education learning provides opportunities for students to engage in physical activities that can be integrated with local culture through movements in traditional games, supporting the development of children's motor executive functions and enhancing physical fitness that can be enjoyed throughout life (Luo et al., 2023; Mahendra et al., 2024; Faghy et al., 2025). The decline in physical activity during physical education classes at schools occurs due to a lack of innovation in teaching and the limited access to conventional learning resources. Therefore, it is necessary to develop engaging and interactive physical activities that incorporate local cultural values to enhance students' physical fitness and character development (Taqwim et al., 2023; El Iq Bali et al., 2021).

The shift from conventional learning toward technology has driven a new wave of the digital revolution in physical education, creating opportunities for innovation and the development of new, technology-based learning medi (Wang et al., 2024; Roemintoyo & Budiarto, 2021; Zhen & Wang, 2024). The integration of digital technology in junior high school physical education has brought significant changes by combining technological innovation with elements of local wisdom to enhance students' socio-emotional development, active engagement, and meaningful learning experiences through the introduction of cultural values and traditional movements unique to local regions as a means of strengthening student character (Zhang et al., 2024). It is expected that the development of educational physical activities will serve as an innovative solution for technology-based physical education learning grounded in local wisdom, enabling students to gain meaningful learning experiences that are easily accessible anytime and anywhere without the limitations of space and time.

The need for engaging, enjoyable, interactive, and character-based physical education learning encourages optimal student participation and has become an important focus in the advancement of educational science and technology. Therefore, the development of an educational physical activity model that integrates local wisdom and technology is necessary to improve the quality of learning in junior high schools while fostering lifelong physical fitness and character development grounded in cultural values, contributing to the realization of the Golden Indonesia Generation vision. In line with research findings by Haqiyah et al. (2021) on the implementation of a flipped classroom

model integrated with an online learning platform and video biomechanical analysis in pencak silat instruction, which has been shown to improve learning outcomes and student engagement, the Afiksed model was developed as a culturally grounded and technology-enhanced physical education approach aimed at promoting active participation, physical fitness, and holistic character development among students.

A review of relevant previous studies indicates that research has evolved from the development of fundamental movements to motor skill enhancement involving physical activities in physical education learning, utilizing various media as learning resources, including instructional books with motion illustrations, videos, and interactive multimedia applications (Lanos, Handayani et.al, 2023; Rohayu et al., 2023; Syaflin et al., 2021; Ritonga et al., 2024; Perabunita et.al, 2025; Handayani et al., 2024; Lanos et al., 2021; Lanos et al., 2024; Lanos, Lestari et al., 2023). Recent studies indicate that the integration of digital technology in physical education has contributed significantly to improving students' physical activity levels, motivation, and engagement in learning. Digital media and interactive applications have also been shown to enhance motor skill understanding and support flexible, student-centered learning environments. Nevertheless, most existing studies primarily employ technology as a content delivery tool and have not fully optimized practical, user-friendly applications designed to create enjoyable learning experiences that are culturally relevant. In addition, limited attention has been given to integrating local wisdom into digital physical education models to strengthen contextual learning and student identity.

Addressing this gap, the present study develops the Educational Physical Activity Model (AFIKSED) based on local wisdom and digitized into an Android-based application. This model is designed to provide an interactive, enjoyable, and accessible physical education learning experience, with the potential to improve students' physical fitness, learning outcomes, and participation. Therefore, this study contributes to the state of the art by combining culturally grounded pedagogy with mobile learning technology, offering an innovative approach to enhancing the quality of physical education in Indonesia.

METHOD

This study employs the Research and Development (R&D) method using the 4D development model proposed by Thiagarajan et al. (1974) and adapted by Sugiyono (2016) and (Muqdamien et al., 2021), which consists of four stages: Define, Design, Develop, and Disseminate. Each stage is carried out systematically to produce an educational physical activity model based on local wisdom that is integrated into digital learning media.

In this study, a total of 30 participants were involved during the needs analysis stage to identify learning needs and assess students' readiness. Following this stage, the study proceeded with expert validation, involving learning experts, content experts, and media experts, to evaluate the feasibility of the developed model. The research was limited to the development and validation of the Afiksed model therefore, it did not include a full-scale field implementation or effectiveness testing. The recommendation for future research is to conduct an effectiveness study with a larger sample once the model has been refined and validated.

The research was conducted through four systematic stages of the 4D development model. 1) The Define stage included analyzing needs, student characteristics, and the learning context through observations, questionnaires, interviews, and focus group discussions (FGDs) with physical education stakeholders. 2) The Design stage focused on creating the initial model and media prototype by developing layouts, storyboards, and flowcharts. 3) The Develop stage involved producing nine educational physical activity models based on traditional games, performing biomechanical movement analyses, and developing a mobile learning application, which was then validated by experts to assess its content and visual feasibility. Finally, 4) The Disseminate stage was implemented through workshops, integration into junior high school learning, and dissemination of research outcomes to the public, education authorities, and relevant institutions.

The research instruments consisted of an observation checklist, semi-structured interview guidelines, expert validation forms, and structured questionnaires designed to evaluate user responses and product feasibility. The questionnaire was developed based on key indicators, including ease of use, instructional attractiveness, clarity of content, cultural relevance, and perceived benefits for students' physical fitness and learning outcomes. All items were organized into an instrument blueprint and measured using a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Prior to data collection, the instruments were reviewed by subject-matter experts to ensure content validity and alignment with the objectives of the product development.

This study employed a Research and Development (R&D) approach adapted from 4D development model, emphasizing product feasibility and practicality testing. Data analysis combined qualitative and quantitative descriptive techniques. Qualitative data obtained from observations and interviews were analyzed through data reduction, categorization, and interpretation to identify key themes. Quantitative data collected from questionnaires and expert validation sheets were analyzed using descriptive statistics in the form of percentages to determine the level of feasibility and user acceptance. The percentage score was calculated using the following formula:

$$P = \frac{\text{Obtained Score}}{\text{Maximum Score}} \times 100$$

The resulting percentages were interpreted based on feasibility criteria to determine the practicality, acceptability, and appropriateness of the developed product.

Table 1. Feasibility interpretation criteria

Percentage	Category	Interpretation
81–100%	Highly Feasible	Product is very valid and practical; usable without revision
61–80%	Feasible	Product is usable with minor revisions
41–60%	Moderately Feasible	Product requires improvement before implementation
21–40%	Low Feasibility	Product requires major revisions
0–20%	Not Feasible	Product cannot be used

FINDINGS AND DISCUSSIONS

Findings

This study produced a Local Wisdom–Based Educational Physical Activity (Afiksed) model integrated into an Android application for Physical Education learning in junior high schools. The application consists of four main menus: physical activity simulations, Physical Education and local culture materials, learning reflection, and interactive quizzes, developed through the systematic stages of the 4D model.

1. Define

At the Define stage, observations, interviews, and literature reviews were conducted to identify the learning needs of Physical Education (PJOK) in junior high schools.

Table 2. Frequency distribution and percentage of junior high school students' observation results

Observed aspect	Dominant category	Percentage (%)	Average score	Description
Activeness	Good	50%	3.7	Students are active and engaged in physical education learning activities.
Enthusiasm	Good	50%	3.5	Students are fairly enthusiastic, though some remain passive.
Motor skills	Good–very good	75%	3.9	Students' fundamental movement skills are generally good and continue to improve.

Use of technology	Poor	65%	2.3	Students are not yet accustomed to using digital media in learning activities

The observation results of 20 junior high school students showed that activeness, enthusiasm, and motor skills were in the good category, with an average score above 3.5. However, the use of technology remained low (average score of 2.3), indicating the need for integrating digital media into Physical Education learning to make it more engaging and aligned with current technological developments.

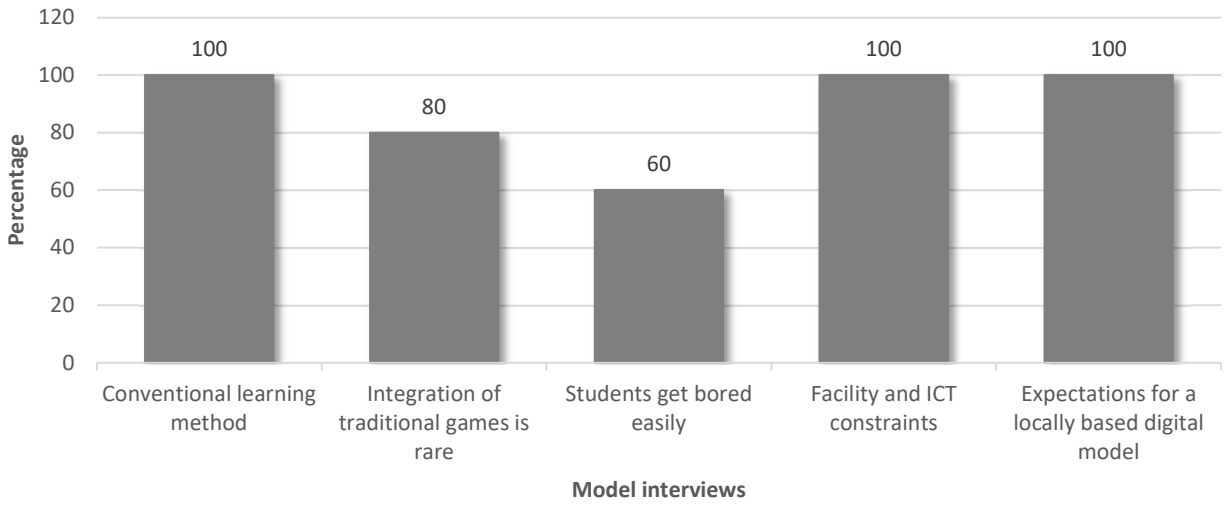


Figure 1. Graph of the percentage results of key findings from physical education teacher interviews

The results of interviews with five junior high school Physical Education teachers indicated that learning remains conventional with minimal use of digital media due to limited facilities and technological skills. The integration of local wisdom, such as traditional games, has not been conducted regularly, even though it is considered effective in improving students' motor skills and character. Teachers also observed that students tend to get bored easily when learning activities lack variety. Therefore, all teachers expressed the need for a simple, engaging Physical Education learning model based on local culture that can be easily accessed via smartphones to better align with the demands of the digital era.

Based on the results of observations and interviews, it was found that Physical Education learning in junior high schools is still dominated by conventional methods without the support of digital media. Local wisdom, such as traditional games, is rarely implemented, and students tend to get bored

easily due to the lack of activity variation. Teachers face challenges related to facilities and ICT skills but express a strong expectation for innovative digital learning that is simple, engaging, and rooted in local culture.

2. Design

The design stage focused on developing an innovative Physical Education (PE) learning model based on local wisdom and technology. After conducting a needs analysis, the researcher designed an Educational Physical Activity Model (Akfised) by identifying target objectives, creating media designs (layout, storyboard, and Android application flowchart), and assigning team tasks according to their expertise. This stage aimed to produce a well-structured design as the foundation for subsequent product development.

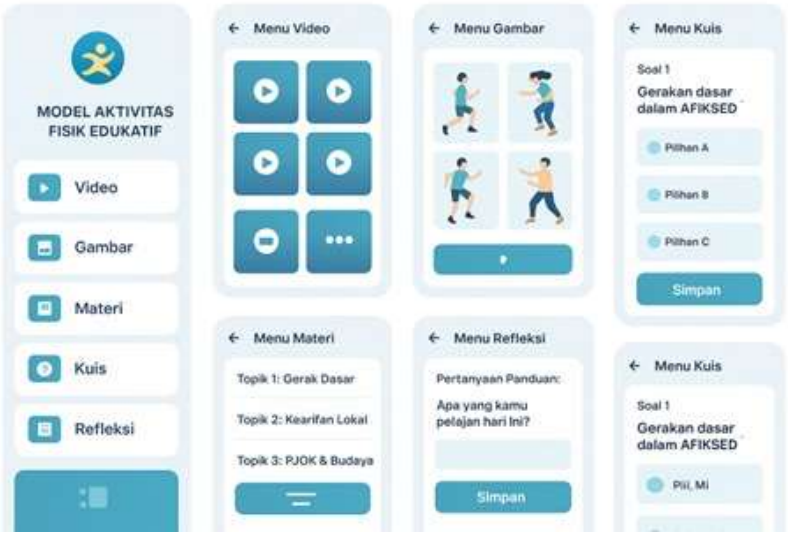


Figure 2. Initial design of the afiksed model application

The initial product developed is a simple, interactive, and user-friendly PJOK mobile learning application with four main menus: 1) Model for educational physical activity simulations, 2) Material presenting PJOK content and local wisdom, 3) Learning Reflection for self-assessment, and 4) Interactive Quiz to evaluate students' understanding in an engaging way

The initial product developed is a mobile learning application designed to support Physical Education learning through digital technology. The application features a simple and interactive interface to ensure ease of use for students.

3. Development

The Educational Physical Activity (Afiksed) learning model was developed by integrating games with fundamental locomotors, non-locomotors, and manipulative movements to enhance motor skills, sportsmanship, cooperation, and the preservation of local cultural values. The model is still in its early stages

and will be refined based on expert feedback before being trialed and integrated into a mobile learning application. Through manipulative exercises such as throwing, catching, kicking, and bouncing a ball, students are trained to improve coordination, accuracy, and movement control. Overall, Afiksed is designed as simple and enjoyable games suitable for students' developmental levels, aiming not only to strengthen basic motor skills but also to foster a sense of togetherness and appreciation for local culture. The following are the developed models.

Table 3. Developed models of educational physical activity (afiksed)

Model Name	Main Movement Focus	Skill Development Objective
Yeye Silang (Yesil)	Jumping and group coordination	Train balance, teamwork, and coordination
Yeye Pindah (Yedah)	Jumping and moving to different positions	Develop rhythm, movement control, and agility
Empat Kotak Sodor Bola	Running and dodging the ball	Train speed, agility, and reaction
Lari Zig-Zag Cone	Zig-zag running through obstacles	Improve agility and directional coordination
Lompat Ganda Tali	Rhythmic double rope jumping	Train concentration, coordination, and endurance
Roda Manusia	Group rotating movements	Foster teamwork and balance
Tangkap Bola Pantul	Bouncing and catching the ball	Train hand-eye coordination and concentration
Estafet Lompat Karung Mini	Jumping and teamwork	Enhance leg strength and teamwork spirit
Lempar Tangkap Tepat Sasaran	Throwing and catching the ball to a target	Train accuracy and manipulative coordination

At the development stage of the Mobile Learning–based Educational Physical Activity (Afiksed) model, a content validity test was conducted by three validators to assess the model's relevance, feasibility, and aspects of content, construction, media, and practicality before trial implementation. The following are the assessment results:

Tabel 4. Expert assessment results

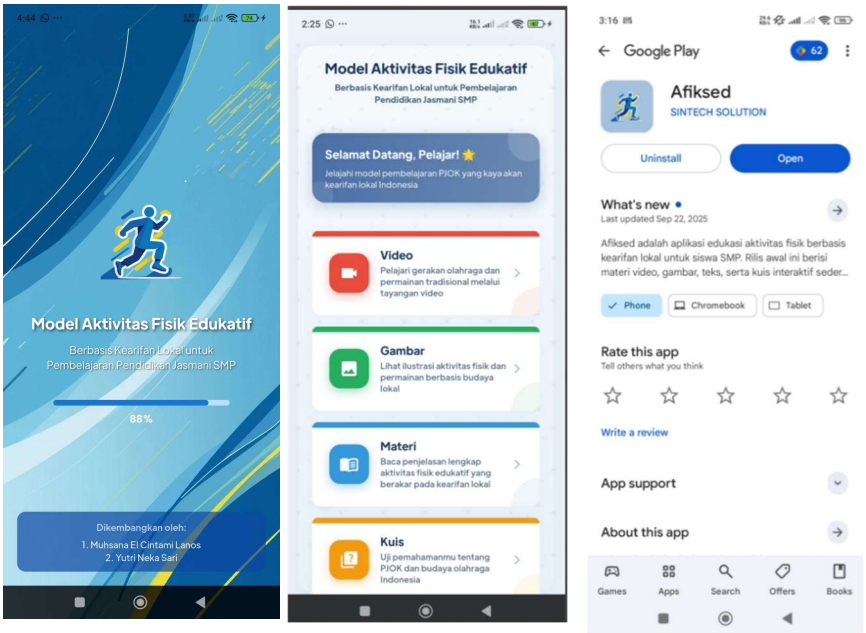
Validator	Total score	Maximum score	Percentage	Category
Learning expert	46	50	92%	Excellent validity
Content expert	45	50	90%	Excellent validity
Media expert	44	50	88%	Excellent validity

6 Based on the assessment results, the Mobile Learning–based Educational Physical Activity (Afiksed) model was declared Highly Valid across all three evaluated aspects. In the learning aspect, it received a score of 46 out of 50 (92%), indicating that the content, curriculum alignment, and clarity of

presentation are excellent. For the basic movement material aspect, the model scored 45 out of 50 (90%), demonstrating that the locomotor, non-locomotor, and manipulative movements presented are appropriate for students' developmental levels and safe to implement. Meanwhile, the media aspect achieved a score of 44 out of 50 (88%), reflecting that the application's interface, interactivity, and ease of navigation effectively support the learning process. Overall, the average validity level reached 90%, confirming that the Afiksed model is feasible for use and ready to proceed to the field trial stage to evaluate its effectiveness in junior high school Physical Education.

Expert revision

The expert assessment results indicated that the Afiksed model requires some revisions. It was suggested that the application interface be improved to be more attractive and responsive, while the movement instructions need to be made clearer and developmentally appropriate to ensure safe practice. These revisions aim to make the model more practical, safe, and ready for implementation in mobile learning–based Physical Education.



Gambar 3. Aplikasi model aktifitas fisik pada platform android

After validation and revision, the Mobile Learning–based Afiksed model was field-tested in three junior high schools in Palembang to evaluate its effectiveness and usability in Physical Education (PJOK) learning. The trial generated data on implementation, student engagement, and teacher feedback, which were then used as the basis for further refinement of the model before wider application.

4. Disseminate

The dissemination of the Educational Physical Activity (Afiksed) model research results is scheduled for November through a workshop within the Community Partnership Program (PKM), involving lecturers, students, schools, and the local community. The workshop aims to provide training on the use of the model and mobile application so that teachers and students can effectively implement it in Physical Education (PJOK) learning. Additionally, the Afiksed model will begin to be integrated into partner schools as an initial step toward practical implementation. The research findings will also be shared with relevant stakeholders to promote broader utilization.

Discussions

The findings of this study indicate that the Local Wisdom–Based Educational Physical Activity (Afiksed) model, integrated into a mobile learning application, is a feasible and effective solution for enhancing PE learning in junior high schools. By combining explicit instruction with play-based activities, the model optimizes key cognitive and motor processes and provides practical guidance for PE teachers, while also contributing to the theoretical development of sports science (Romadhoni, 2025).

The needs analysis revealed that although students demonstrate good activeness, enthusiasm, and motor skills, the use of digital technology in PE learning remains limited. This finding suggests that Physical Education instruction continues to lag behind other subjects in the integration of technology, despite students' growing familiarity with digital media (Lanos, Handayani et al., 2023).

The results of teacher interviews further emphasize that conventional teaching methods and limited integration of local wisdom contribute to student boredom and reduced learning variation. The limited use of traditional games indicates underutilization of culturally meaningful resources, despite their proven benefits for motor skills, social interaction, and character (Handayani et al., 2024). Therefore, the development of the Afiksed model responds directly to the dual need for technological innovation and cultural contextualization in PE learning.

The design of the Afiksed model aligns with constructivist learning principles, where students actively engage with learning content through simulations, reflection, and interactive assessment. The inclusion of reflection and quizzes supports meaningful learning by encouraging students to evaluate their experiences and understanding (Haqiyah et al., 2021). Moreover, the use of a mobile learning platform enhances learning flexibility and accessibility, which has been shown to increase student motivation and engagement in PE contexts (Lanos et al., 2021).

During the development stage, the incorporation of fundamental locomotors, non-locomotors, and manipulative movements into game-based activities aligns with motor learning principles, emphasizing diverse and developmentally appropriate movement experiences. The high expert validation scores across learning, content, and media components indicate that the Afiksed model is pedagogically sound, safe, and well-suited for junior high school students. These results suggest that mobile-assisted PE models can effectively enhance skill development when designed with clear instructions and an intuitive, user-friendly interface. Overall, the Afiksed model advances Physical Education learning by systematically integrating local wisdom with mobile learning technology. Field testing indicates that the model is practical and positively received in classroom settings, highlighting the potential of culturally grounded, technology-enhanced physical activity models to enrich PE instruction and sustain student engagement in the digital era

CONCLUSION

The Mobile Learning–based Educational Physical Activity (Afiksed) model is deemed feasible and effective for use in Physical Education (PJOK) learning. This model enhances students' fundamental movement skills while fostering teamwork and sportsmanship through developmentally appropriate activities. Its user-friendly interface and clear movement instructions make Afiksed practical for school implementation, positioning it as a promising innovation for more interactive and meaningful PJOK learning.

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REFERENCE

Chen, X., Zhang, C. X., Stone, T., & Lamb, J. (2020). Existentially Understanding Tourism in Locale: A Dwelling Perspective. *Annals of Tourism Research*, *80*(April 2019), 102828. https://doi.org/10.1016/j.annals.2019.102828

El Iq Bali, M. M., Baharun, H., Madanibillah, A., Muali, C., Lukman, Anam, N. K., … Bon, A. T. (2021). Innovative Learning Media Based on E-Learning in the New Normal Era. *Proceedings of the International Conference on Industrial Engineering and Operations Management*, 6987–6993.

https://doi.org/10.46254/an11.20211210

Faghy, M. A., Carr, J., Broom, D., Mortimore, G., Sorice, V., Owen, R., … Ashton, R. E. M. (2025). The Inclusion and Consideration of Cultural Differences and Health Inequalities in Physical Activity Behaviour in the Uk - the Impact of Guidelines and Initiatives. *Progress in Cardiovascular Diseases*, (January). https://doi.org/10.1016/j.pcad.2025.01.009

Guthold, R., Stevens, G. A., Riley, L. M., & Bull, F. C. (2020). Global Trends in Insufficient Physical Activity among Adolescents: A Pooled Analysis of 298 Population-Based Surveys with 1·6 Million Participants. *The Lancet Child and Adolescent Health*, *4*(1), 23–35. https://doi.org/10.1016/S2352-4642(19)30323-2

Handayani, W., Cintami, M. El, & Lestari, H. (2024). Impact of Hadang and Bentengan Game on Students' Physical Fitness Levels. *Al-Ishlah Jurnal Pendidikan,* *16*(3), 3160–3169. https://doi.org/10.35445/alishlah.v16i3.5734

Haqiyah, A., Lubis, J., Tangkudung, J., Muhamad, M., Kusumawati, M., Lanos, M. E., & Riyadi, D. N. (2021). Flipped Classroom Model Integrated with the Online Learning Platform and Video Biomechanic Analysis to Enhance Learning Outcome of Pencak Silat during the Covid-19 Pandemic. *Turkish Journal of Computer and Mathematics Education*, *12*(11), 2267–2272. https://doi.org/10.17762/turcomat.v12i11.6219

Hulteen, R. M., Barnett, L. M., True, L., Lander, N. J., del Pozo Cruz, B., & Lonsdale, C. (2020). Validity and Reliability Evidence for Motor Competence Assessments in Children and Adolescents: A Systematic Review. *Journal of Sports Sciences*, *00*(00), 1717–1798. https://doi.org/10.1080/02640414.2020.1756674

Kamijo, K., McGowan, A. L., & Pontifex, M. B. (2019). Effects of physical activity on cognition in children and adolescents. In M. H. Anshel, S. J. Petruzzello, & E. E. Labbé (Eds.), *APA handbook of sport and exercise psychology: Exercise psychology* (pp. 331–343). American Psychological Association. https://doi.org/10.1037/0000124-017

Lanos, M. E. C., Ihsan, N., Okilanda, A., Manullang, J. G., & Hikmah Lestari. (2021). Effectiveness of Interactive Multimedia Supported Physical Education Using Jurus Tunggal Tangan Kosong In the New Normal Era. *International Journal of Human Movement and Sports Sciences*, *11*(2), 261–267. https://doi.org/10.13189/saj.2023.110201

Lanos, M. E. C., Handayani, W., Manullang, J. G., & Sinaga, V. (2023). The Effectiveness of Multimedia Interactive Model on Pencak Silat Basic Motion Learning. *AL-ISHLAH: Jurnal Pendidikan*, *15*(4), 5870–5876.

https://doi.org/10.35445/alishlah.v15i4.4627

Lanos, M. E. C., Lestari, H., Iswana, B., Okilanda, A. (2023). Development of Short Story Basic Movement Trhow-Cacth At Elementary School. *Halaman Olahraga Nusantara*, *6*(1), 299–307. https://doi.org/10.31851/hon.v6i1.6819

Lanos, M. E. C., Handayani, W., Manullang, J. G., Winartiningsih, & Festiawan R. (2024). Development of Interactive Manipulative Motion Learning Media Using Adobe Animate for Elementary School Students. *Jurnal Keolahragaan*, *12*(2), 184–194. https://doi.org/10.21831/jk.v12i2.76328

Luo, X., Herold, F., Ludyga, S., Gerber, M., Kamijo, K., Pontifex, M. B., Hillman, C. H., Alderman, B. L., Müller, N. G., Kramer, A. F., Ishihara, T., Song, W., & Zou, L. (2023). Association of Physical Activity and Fitness with Executive Function among Preschoolers. *International Journal of Clinical and Health Psychology*, *23*(4), 100400. https://doi.org/10.1016/j.ijchp.2023.100400

Mahendra, A., Lanos, M. E. C., & Imansyah, F. (2024). Pengembangan Gerak Dasar Lokomotor melalui Pendekatan Bermain Tingkat SD. *Halaman Olahraga Nusantara (Jurnal Ilmu Keolahragaan)*, *7*(I), 91–98. https://doi.org/10.31851/hon.v7i1.13849

Miyawaki, C., Ohara, K., Mase, T., Kouda, K., Fujitani, T., Momoi, K., … Nakamura, H. (2019). The Purpose and the Motivation for Future Practice of Physical Activity and Related Factors in Japanese University Students. *Journal of Human Sport and Exercise*, *14*(1), 61–74. https://doi.org/10.14198/jhse.2019.141.05

Lanos, M. E. C., Handayani, W., Manullang, J. G., Winartiningsih, & Festiawan R. (2024). Development of Interactive Manipulative Motion Learning Media Using Adobe Animate for Elementary School Students. *Jurnal Keolahragaan*, *12*(2), 184–194. https://doi.org/10.21831/jk.v12i2.76328

Muqdamien, B., Umayah, U., Juhri, J., & Raraswaty, D. P. (2021). Tahap Definisi dalam Four-D Model Pada Penelitian Research & Development (R&D) Alat Peraga Edukasi Ular Tangga untuk Meningkatkan Pengetahuan Sains dan Matematika Anak Usia 5-6 Tahun. *Intersections*, *6*(1), 23–33. https://doi.org/10.47200/intersections.v6i1.589

Perabunita, Lanos, M. E. C., Handayani, W., Lestari, H., Iswana, B. (2025). Development of Locomotor Basic Motion Learning Through Traditional Games at The Elementary School Level. *Halaman Olahraga Nusantara: Jurnal Ilmu Keolahragaan,* *8*(1), 58–68. https://doi.org/10.31851/hon.v8i1.17383

Ritonga, I., Gusril, G., Kiram, Y., Lanos, M. E. C., & Festiawan, R. (2024).

Designing an Innovative Learning Model for Fundamental Throwing and Catching Skills Using the Teaching Games for Understanding (Tgfu) Approach in Elementary Education. *Retos*, *61*, 448–454. https://doi.org/10.47197/retos.v61.108823

Roemintoyo, R., & Budiarto, M. K. (2021). Flipbook as Innovation of Digital Learning Media: Preparing Education for Facing and Facilitating 21st Century Learning. *Journal of Education Technology*, *5*(1), 8. https://doi.org/10.23887/jet.v5i1.32362

Rohayu, S., Lanos, M. E. C., & Handayani, W. (2023). Development of Low Impact Aerobics Gymnastics Model for the Elderly Level at Sanggar Mawar Jingga Palembang City. *Journal of Social Work and Science Education*, *4*(3), 1104–1111. https://doi.org/10.52690/jswse.v4i3.656

Romadhoni, W. N., Aji, T., Priambodo, E. N., & Semarang, U. N. (2025). Enhancing Junior High Students' Understanding Of Gross Motor Skills With Traditional Game Play In PE. *Multilateral : Jurnal Pendidikan Jasmani dan Olahraga* *24*(3), 432–446. http://dx.doi.org/10.20527/multilateral.v24i3.22736

Sugiyono. (2016). *Metode Penelitian Pendidikan: Pendekatan Kuantitaif, Kualitatif, dan R&D*. Bandung: Alfabeta.

Syaflin, H. M., Nurdin, F., Widiastuti, Syafaruddin, Lanos, M. E. C., & Syaflin, S. L. (2021). Basic Locomotor Motion Characteristic Design Using Games Model for Elementary School Student. *International Journal of Human Movement and Sports Sciences*, *9*(3), 560–567. https://doi.org/10.13189/saj.2021.090323

Taqwim, A., Handayani, W., Riyanto, A., Hamid, S., & Khoirudin, M. (2023). *Penerapan Pembelajaran Daring Menggunakan Aplikasi Discord Materi Lari 100 Meter Di Smp Negeri 2 Rejang Lebong, Riyadhoh : Jurnal Pendidikan Olahraga* *6*(1), 102–108. https://doi.org/10.31602/rjpo.v6i1.10975

Thiagarajan, S., Semmel, D. S., & Semmel, M. I. (1974). *Instructional Development for Training Teachers of Exceptional Children.* Leadership Training Institute/Special Education, University of Minnesota

Vanderloo, L. M., Bruijns, B. A., Kuzik, N., Stone, E., & Tremblay, M. S. (2025). Impact of the ParticipACTION Report Card on physical activity for children and youth in Canada: 2015–2024. *Journal of Exercise Science and Fitness*, *23*(2), 102–111. https://doi.org/10.1016/j.jesf.2025.01.005

Wang, H., Huo, M., Zhao, Y., He, J., & He, J. (2024). Physical Education Consumption and Executive Function among Older Empty Nesters in Urban Community: A Double Mediation Effects. *Acta Psychologica*, *249*(August), 1–

7. https://doi.org/10.1016/j.actpsy.2024.104464

Yoo, P. Y., Kumari, S., Stephens, S., & Yeh, E. A. (2024). Social Network Characteristics and Their Relationships with Physical Activity in Children With Multiple Sclerosis. *Multiple Sclerosis and Related Disorders*, *91*(March), 105865. https://doi.org/10.1016/j.msard.2024.105865

Zhang, J., Sloss, I. M., Maguire, N., & Browne, D. T. (2024). Social and Emotional Learning : Research, Practice, and Policy Physical Activity and Social-Emotional Learning in Canadian Children : Multilevel Perspectives Within an Early Childhood Education and Care Setting. *Social and Emotional Learning: Research, Practice, and Policy*, *4*(October), 100069. https://doi.org/10.1016/j.sel.2024.100069

Zhen, A., & Wang, X. (2024). The Deep Learning-Based Physical Education Course Recommendation System Under the Internet of Things. *Heliyon*, *10*(19), e38907. https://doi.org/10.1016/j.heliyon.2024.e38907