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The Effectiveness of Deep Learning Inclusion on Independence and Fitness in Junior High Students

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Keywords

Deep Learning Inclusion; Adaptive Physical Education; Student Independence; Physical Fitness

Abstract

This study aims to examine the effectiveness of inclusion-based adaptive physical education integrated with a deep learning approach in enhancing the independence and physical fitness of junior high school students. A quasi-experimental method with a pretest–posttest control group design was employed. The sample consisted of students divided into experimental and control groups. Data were collected using validated and reliable physical fitness tests and independence questionnaires. Data analysis involved descriptive statistics and inferential tests, including paired sample t-tests and independent t-tests.The findings revealed a significant improvement in both independence and physical fitness among students in the experimental group compared to the control group ($p < 0.05$). The integration of deep learning within inclusive physical education fostered greater student engagement, improved understanding of movement concepts, and supported the development of physical and psychosocial competencies. Moreover, this approach created a more meaningful, adaptive, and student-centered learning environment. In conclusion, inclusion-based adaptive physical education integrated with a deep learning approach is effective in improving students' independence and physical fitness. These results offer practical implications for developing innovative and sustainable physical education learning models.

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INTRODUCTION

Adaptive physical education learning in the context of inclusion requires an approach that is able to accommodate the diversity of students' abilities while encouraging active involvement in the learning process. Theoretically, deep learning emphasizes conceptual understanding, reflection, and active cognitive and affective engagement in the learning process(Taqiyya et al., 2025). In physical education, integration Deep Learning It is believed to strengthen the relationship between movement understanding, learning experience, and the development of physical fitness and student independence. In addition, the theory self-determination (Deterding et al., 2025) affirming that autonomy and competence are important factors in building individual independence, which is relevant to the goals of inclusive learning.

The urgency of this research lies in addressing the gap between the ideal implementation of inclusive physical education and its current practice in junior high schools. Preliminary observations indicate that learning is still dominated by conventional approaches, resulting in limited participation of students with special needs and suboptimal development of independence and physical fitness. Additionally, survey findings reveal that many students have not reached adequate fitness levels and remain highly dependent on teacher instructions when performing movement tasks.

These conditions highlight a critical need for innovative, adaptive, and student-centered learning models that can actively engage all learners and foster both physical and psychosocial development. Without such improvements, inclusive physical education may fail to achieve its fundamental goals of equity, participation, and holistic student development. Therefore, this research is urgent as it seeks to provide an effective solution through the integration of deep learning approaches in inclusive adaptive physical education contex (Jariono et al., 2021; Nurhidayat et al., 2023; Sunanto et al., 2025).

A number of previous studies support the importance of integrating innovative approaches in physical education. Study by Rosero & Inga, (2025) shows that inclusive learning based on active participation can improve student engagement and learning outcomes. Other research by Kilpeläinen et al. (2025) emphasized that technology-based pedagogical approaches and deep understanding are able to improve the quality of physical education learning. In addition, recent research by (Abady et al., 2025) and (Martín-Rodríguez & Madrigal-Cerezo, 2025) It shows that the integration of innovative learning models contributes significantly to the improvement of students' physical fitness and social skills. Similar findings were also reported by (Işıkgöz, 2025) and (Su & Liu, 2025) which emphasizes the importance of a student-centered approach in increasing motivation and independence in learning.

Based on this description, the formulation of the problem in this study is whether inclusion-based adaptive physical education learning integrated with deep learning is effective in increasing the independence and physical fitness of junior high school students. This study aims to test the effectiveness of this approach through experimental methods. The hypothesis proposed is that there is a significant influence of inclusive deep learning learning on the improvement of independence and physical fitness of junior high school students compared to conventional learning.

Research Methods

This study uses a quantitative approach with a quasi-experimental design in the form of a pretest-posttest control group design (Jariono et al., 2025). This design was chosen to test the effectiveness of deep learning-integrated inclusion-based adaptive physical education learning on students' independence and physical fitness.

Research Tools/Designs/Instruments

The instruments used include: (1) a student independence questionnaire based on the Likert scale, (2) a physical fitness test that refers to the components of endurance, strength, and speed, and (3) an observation sheet for learning implementation. All instruments have gone through content validity and reliability tests (Cronbach's Alpha > 0.70).

Research Subject/Object

The subjects of the study were all students of Madrasah Tsanawiyah Muhammadiyah 04 Blagung, Blagung, Simo, Boyolali, Central Java Postal Code 57377 who participated in adaptive physical education learning. The sample was determined using a purposive sampling technique, with a total of 40 students divided into two groups, namely the experimental group (n=20) and the control group (n=20). The experimental group was given an inclusive deep learning-based learning treatment, while the control group used conventional learning.

Data Type

The data collected was in the form of quantitative data, including independence scores and physical fitness test results before and after treatment. Student independence questionnaire (Likert scale 1–5) and Physical fitness test (20-meter run, sit-up, push-up, and shuttle run)

METHODS

section of the method contains a research approaches, models and procedures of research, and his other (Wild, 1995). On qualitative research, for the '90s method things written, among others, approach, the paradigm used, focus research, time, place of study, subject/object of research, data mining techniques, techniques and principle improvement the accuracy of the data, and analysis. Quantitative research on the things that are written, among other approaches, the place of research, population, samples, variables, data collection techniques, data validity, measurement techniques and data analysis techniques. In addition, on the research of quantitative, no need to redundantly statistical formulas written in the section of the method.

If the article is written is the result of research the research development, it is necessary & added prototype created with description and how to use it. But for this kind of qualitative approach where necessary written description more detail, for example the approach phenomenology study, history, analysis of discourse, writers can still write research methods.

Table 1. Indicators and Sub-Indicators of Student Independence

Indicator	Sub Indicators
Learning Initiative	- Start an activity without being told - Finding solutions when experiencing difficulties
Responsibilities	- Complete tasks independently - Maintain commitment to activities
Confidence	- Dare to try new things. - Not easy to give up
Decision Making	- Choosing the right movement strategy - Prioritize activities
Self-Discipline	- Setting a workout time - Obey the rules of the activity
Perseverance	- Practice consistently - Focus on completing activities
Self-Reflection	- Evaluate the results of the activity - Receive feedback

All instruments have gone through validity ($r > 0.30$) and reliability ($\alpha > 0.70$).

Research Procedure

The research was carried out for 8 weeks starting from November 2025 to January 2026 with stages:

Pretest (initial measurement of independence and fitness)
Treatment (deep learning inclusion) in the experimental group
Posttest (final measurement)

Data Collection Techniques

Data collection was carried out through direct tests and measurements for physical fitness, as well as the distribution of questionnaires to measure student independence. Observations are carried out to ensure the implementation of the learning model.

Data Analysis Techniques

Data analysis was carried out using descriptive and inferential statistics. Prerequisite tests include normality and homogeneity tests. Hypothesis testing uses a paired sample t-test to see differences in groups, as well as an independent sample t-test to compare between groups.

Formula (t-test)

The hypothesis test calculation uses the formula:

$$t = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\frac{S_1^2}{n_1} + \frac{S_2^2}{n_2}}}$$

Remark:

$\bar{X}_1$ = average experimental group
$\bar{X}_2$ = average control group
S_1^2, S_2^2 = variance
n_1, n_2 = number of samples

This formula is used to determine the significance of differences in outcomes between research groups. Overall data analysis using SPSS Version 27 software.

RESULTS AND DISCUSSION

This study involved as many as 40 junior high school (SMP) students as participants divided into experimental groups and control groups. The variables analyzed included the application of inclusion-based deep learning learning as an independent variable (X), as well as students' independence and physical fitness as a bound variable (Y). Data analysis was carried out through descriptive statistical stages, normality assumption testing, and hypothesis testing using paired sample t-test and independent sample t-test techniques to identify significant differences and effects of treatment.

Descriptive Analysis

Descriptive statistical analysis was applied to comprehensively outline the characteristics of the research data, which included the average values, standard deviations, and data ranges indicated through minimum and maximum values on the variables of student independence and physical fitness in the context of deep learning-based learning inclusion.

Table 1. Descriptive data

Variable	Groups	Pretest (Mean±SD)	Posttest (Mean±SD)
Independence	Exp.	65.20 ± 5.10	82.45 ± 4.85
	Cont.	64.75 ± 5.25	70.30 ± 5.10
Physical Fitness	Exp.	60.10 ± 6.20	78.90 ± 5.75
	Cont.	59.85 ± 6.10	66.40 ± 5.95

*Exp: Experiments; Cont: Control

Based on Table 1 regarding descriptive analysis, it can be seen that there is a change in the average value and standard deviation in the variables of independence and physical fitness between the pretest and posttest in the two study groups. In the independence variable, the experimental group showed a considerable increase from the average score of 65.20 ± 5.10 in the pretest to 82.45 ± 4.85 in the posttest. In contrast, the control group also improved, but on a lower scale, from 64.75 ± 5.25 to 70.30 ± 5.10. This indicates that inclusion-

based deep learning-based learning interventions have a more optimal impact on increasing student independence compared to conventional learning.

In the physical fitness variables, a similar pattern was also seen. The experimental group experienced a significant increase from an average score of 60.10 ± 6.20 in the pretest to 78.90 ± 5.75 in the posttest. Meanwhile, the control group only increased from 59.85 ± 6.10 to 66.40 ± 5.95. In addition to the increase in average scores, there was also a decrease in the standard deviation in the experimental group, which showed that the posttest results became more homogeneous or even among students.

Data Normality Test

The test of data normality in this study was carried out using the Shapiro–Wilk method to verify that the data distribution meets the assumption of normality as a prerequisite before further analysis is carried out.

Table 2. Data Normality

Variable	Groups	Sig. (Shapiro-Wilk)
Independence	Exp.	0.182
	Cont.	0.101
Physical Fitness	Exp.	0.170
	Cont.	0.115

All research variables showed a significance value (p-value) greater than 0.05, so it can be interpreted that the data has a normal distribution. Thus, the assumption of normality has been fulfilled and the data is declared worthy of further analysis using the t-test technique.

Hypothesis Test

Table 3. Paired Sample t-test results (Pretest vs Posttest)

Variable	Groups	t-count	Sig. (p-value)
Independence	Exp.	9.45	0.000
	Cont.	3.10	0.038
Physical Fitness	Exp.	10.12	0.000
	Cont.	3.35	0.021

Table 4. Independent Sample t-test (Posttest) results

Variable	t-count	Sig. (p-value)
Independence	6.82	0.000
Physical Fitness	7.25	0.000

Based on the results of the paired sample t-test presented in Table 3, it can be seen that there is a significant increase between the pretest and posttest scores on the variables of independence and physical fitness, both in the experimental group and the control group. In the experimental group, the t-value calculated for independence was 9.45 with a significance of 0.000, and for physical fitness was 10.12 with a significance of 0.000. This value shows a very significant increase after the implementation of inclusion-based deep learning-based learning. Meanwhile, in the control group, the t-value of self-reliance was 3.10 (p = 0.038) and physical fitness was 3.35 (p = 0.021), which also showed a significant improvement, but with a lower level of influence than the experimental group.

Furthermore, the results of the independent sample t-test in Table 4 show a significant difference between the experimental group and the control group in the posttest results. The t-value calculated for independence was 6.82 and physical fitness was 7.25, with a significance value of 0.000 ($p < 0.05$ each). This indicates that there is a statistically significant difference,

where the group that received the deep learning inclusion learning treatment showed superior results compared to the group that used conventional learning methods.

Overall, these findings confirm that the application of inclusion-based adaptive physical education learning integrated with deep learning has a higher effectiveness in increasing the independence and physical fitness of junior high school students, both from the increase in groups and comparisons between groups.

The findings of this study show that inclusion-based adaptive physical education learning integrated with deep learning has high effectiveness in increasing the independence and physical fitness of junior high school students. Empirically, a significant increase in the experimental group compared to the control group confirmed that technology-based approaches and personalized learning were able to optimize physical and psychosocial learning outcomes.

These findings are in line with various cutting-edge studies showing that the integration of artificial intelligence (Artificial Intelligence) in physical education allows for more precise monitoring of student performance and the provision of personalized and adaptive feedback, so that it has a direct impact on improving the quality of learning (Muhammad Sukron Fauzi, 2025) and (Ezzaim et al., 2025). Technology-based Deep Learning Enable real-time motion data analysis, so teachers can adjust learning strategies will individual needs of students (Balci & Meylani, 2025). In addition, this approach has also been proven to increase student engagement through a more interactive and data-driven learning experience(Kaleci et al., 2025).

Furthermore, the Deep Learning In the context of physical education, it not only has an impact on the cognitive aspect, but also contributes significantly to improving physical fitness components such as speed, strength, and endurance. Research by Hsia et al. (2025) It shows that the use of smart technology in physical exercise can significantly improve sprint performance, muscle strength, and movement efficiency compared to conventional methods. Another study also confirms that the use of AI-based adaptive learning systems can increase students' aerobic and anaerobic capacity through a more structured and personalized exercise program (Wu et al., 2025). In addition, research by Verdoes et al. (2025) revealed that the integration of innovative approaches in physical education contributes to the overall improvement of students' movement quality and motor skills.

The results of this study are consistent with and extend previous research in the field of inclusive and technology-enhanced physical education. From an inclusion perspective, the present findings demonstrate that the integration of AI-based technology can broaden participation among students with diverse needs while fostering greater independence in physical activities. This aligns with Rosa (2025)), who reported that AI utilization in sports reduces participation barriers and enhances individuals' quality of life and autonomy.

Furthermore, the observed improvements in student engagement, motivation, and learning outcomes support the findings of Lucius & Daryanto (2024), who emphasized the effectiveness of adaptive and differentiated learning approaches. Similarly, the increase in physical performance and intrinsic motivation identified in this study is in line with Ge et al. (2024), highlighting the positive impact of digital technology in physical education contexts.

In a broader context, this study corroborates global trends indicating that the integration of smart technologies, including deep learning, serves as an innovative strategy to enhance learning effectiveness and student outcomes (Zhong et al., 2025) & (Bofill et al., 2025). The significant improvement in physical fitness found in this research also supports experimental evidence from Ginanjar et al. (2025), which demonstrated the superiority of innovative learning models over traditional approaches. Additionally, the role of teacher support in deep learning-based instruction, as noted by (Bachtiar et al. (2025), is reflected in the increased student attention and skill development observed in this study.

Overall, these findings reinforce that inclusion-based adaptive physical education integrated with deep learning not only improves physical fitness but also promotes student independence through adaptive, personalized, and meaningful learning experiences.

CONCLUSION

The results of the study show that deep learning integrated inclusion-based adaptive physical education learning is effective in increasing the independence and physical fitness of junior high school students. These findings are supported by a significant improvement in the experimental group compared to the control, both descriptively and inferentially ($p < 0.05$). Substantively, this model is able to strengthen students' active engagement, decision-making abilities, and physical capacity. Thus, deep learning inclusion can be recommended as an innovative approach to optimize physical education learning outcomes in a holistic and sustainable manner.

REFERENCES

Abady, A. N., Butar Butar, P. W. M. B. B., Longakit, J., & Gordichev, V. G. (2025). Technological innovations and pedagogical advancements in basketball skill learning: A systematic review of high school physical education. *INSPIREE: Indonesian Sport Innovation Review, 6*(2),117-129. https://doi.org/10.53905/inspiree.v6i02.149

Bachtiar, B., Lestari, A. T., Nurina, T., Adil, A., & Setiawan, E. (2025). Effect of teacher encouragement during deep learning on attention and volleyball techniques among students at high school physical education. *Edu Sportivo: Indonesian Journal of Physical Education, 6*(3), 274–284. https://doi.org/10.25299/esijope.2025.vol6(3).25752

Balci, M., & Meylani, R. M. (2025). AI and assistive technologies for equitable and inclusive education: A comprehensive review of the contemporary research literature. *4th International Science, Education, Art & Technology Symposium, 9*(11), 383–402. https://doi.org/10.1038/s41598-022-26846-z

Bofill, J., Pla-Campas, G., & Sebastiani, E. M. (2025). Is artificial intelligence an educational resource in physical education? A systematic review. *Apunts. Educacion Fisica y Deportes, 160*, 1–9. https://doi.org/10.5672/apunts.2014-0983.es.(2025/2).160.01

Deterding, S., Guckelsberger, C., Lintunen, E. M., & Ady, N. M. (2025). Advancing self-determination theory via computational modelling: The case of competence and optimal challenge. *Motivation and Emotion*. https://doi.org/10.1007/s11031-025-10156-8

Ezzaim, A., Dahbi, A., Aqqal, A., & Haidine, A. (2025). AI-based learning style detection in adaptive learning systems: A systematic literature review. *Journal of Computers in Education, 12*(3), 731–769. https://doi.org/10.1007/s40692-024-00328-9

Ge, L., Li, M., & Ning, C. F. (2024). Modern software and physical education: Can online training enhance gym training? *BMC Medical Education, 24*(1), 1–9. https://doi.org/10.1186/s12909-024-05345-x

Ginanjar, S., Samsudin, S., & Rihatno, T. (2025). Comparison of physical fitness of students between sport education model and conventional at junior high school 3 Lembang. *International Journal of Disabilities Sports and Health Sciences, 8*(2), 170–181. https://doi.org/10.33438/ijdshs.1549146

Hsia, L.-H., Hwang, G.-J., Lin, Y.-N., & Hwang, J.-P. (2025). Artificial intelligence-supported physical education during the pandemic: A physical skill auto-assessment and feedback approach based on a reflection-promoting mechanism. *Educational Technology Research and Development, 73*(3), 1429–1450. https://doi.org/10.1007/s11423-025-10452-7

Işıkgöz, M.E. (2025). Intrinsic vs. extrinsic motivation in high school physical education: Which fuels adol escent achievement emotions better? *Plos One, 20*(6), Article e0327393. https://doi.org/10.1371/journal.pone.0327393

Jariono, G., Nurhidayat, Sudarmanto, E., Kurniawan, A. T., & Nugroho, H. (2021). Strategies to teach childr en with special needs amid COVID-19 pandemic. *Linguistics and Culture Review, 5*(S1), 633–641. http://lingcure.org/index.php/journal/article/view/1448

Jariono, G., Usman, A., Ihsan, A., & Nurhidayat, N. (2025). *Metode penelitian pendidikan jasmani dan olahraga* (Cetakan I). Depok: RajaGrafindo Persada.

Kaleci, F., Keser Ateş, S., & Erdoğan, A. (2025). Generative artificial intelligence in education: A bibliometric analysis. *Hmet Keleşoğlu Faculty of Education Journal (AKEF), 7*(1), 14–36. https://doi.org/10.1557557

Kilpeläinen-Pettersson, J., Koskinen, P., Lehtinen, A., & Mäntylä, T. (2025). Cooperative learning in higher education physics – A systematic literature review. *International Journal of Science and Mathematics Education, 23*(7), 2707–2729. https://doi.org/10.1007/s10763-024-10538-3

Lucius, R. L., & Daryanto, Z. P. (2024). Optimizing differentiated learning in physical education subjects: Utilization of information and communication technology (ICT). *Indonesian Journal of Physical Education and Sport Science, 4*(1), 97–103. https://doi.org/10.52188/ijpess.v4i1.587

Martín-Rodríguez, A., & Madrigal-Cerezo, R. (2025). Technology-enhanced pedagogy in physical education: Bridging engagement, learning, and lifelong activity. *Education Sciences, 15*(4), Article 409. https://doi.org/10.3390/educsci15040409

Muhammad Sukron Fauzi, E. Y. L. J. I. A. P. (2025). Physical education in the era of artificial intelligence: The impact of AI technology on enhancing sports learning in schools. *TOFEDU: The Future of Education Journal, 4*(4), 1. https://journal.tofedu.or.id/index.php/journal/index

Nurhidayat, N., Jariono, G., Sudarmanto, E., Subekti, N., & Nugroho, H. (2023). How to improve special needs children's motor skills by modifying circuit exercises. *International Journal of Human Movement and Sports Sciences, 11*(6), 1244–1252. https://doi.org/10.13189/saj.2023.110608

Rosa, J. P. P. (2025). The potential role of artificial intelligence to promote the participation and inclusion in physical exercise and sports for people with disabilities: A narrative review. *Journal of Bodywork and Movement Therapies, 42*, 127–131. https://doi.org/10.1016/j.jbmt.2024.12.024

Rosero, X., & Inga, E. (2025). Transforming inclusive education through gamification and active learning strategies. *Information, 16*(9), Article 753. https://doi.org/10.3390/info16090753

Su, W., & Liu, Q. (2025). The impact of physical education teacher support on sport participation among college students: The chain mediating effects of physical education learning motivation and self-efficacy. *Frontiers in Psychology, 16*, Article 1592753. https://doi.org/10.3389/fpsyg.2025.1592753

Sunanto, R., Jariono, G., Sistiasih, V. S., & Subekti, N. (2025). Peningkatan keterampilan gerak dasar lokomotor melalui permainan tradisional Gobak Sodor pada siswa kelas V SDN Laban 02 Kec. Mojolaban. *Pendas: Jurnal Ilmiah Pendidikan Dasar, 10*(1), 538–548.

Taqiyya, W., Utami, R. D., Samsuri, M., & Siswanto, H. (2025). Strategies of deep learning to foster meaningful and sustainable education in the 21st century. *Journal of Deep Learning, 1*(1), 11–24. https://doi.org/10.23917/jdl.v1i2.11609

Verdoes, L., Dikken, J., Brakel-van Lobenstein, N. van, van Leeuwen-Prins, S. T., de Waal, M. G., & Renden, P. G. (2025). Embracing a constraints-led approach for skills acquisition in nursing education: Insights from a focus group study. *International Journal of Educational Research Open, 9*, Article 100459. https://doi.org/10.1016/j.ijedro.2025.100459

Wu, Q., Han, Z., Hao, Z., Chen, J., & Pan, Y. (2025). Impact of flipped classroom method in physical education on the intrinsic motivation, self-efficacy, and learning satisfaction: A meta-analysis. *PLOS ONE, 20*(5), Article e0324609. https://doi.org/10.1371/journal.pone.0324609

Zhong, Q., Jiang, J., Bai, W., Yin, Z., Liao, Z., & Zhong, X. (2025). Application of digital-intelligent technologies in physical education: A systematic review. *Frontiers in Public Health, 13*, Article 1626603. https://doi.org/10.3389/fpubh.2025.1626603