

The impact of three-level differentiated instruction on junior high school students' badminton performance

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ABSTRACT

Badminton is included as one of the physical education subjects at the primary and secondary school levels in Indonesia. However, based on research, the achievements in badminton at general schools are still low. In class 8 at Junior High School (JHS) Negeri 2 Sleman, with a sample of 31 students who participated in a diagnostic test, only 3 students met the minimum criteria, resulting in a 91% failure rate. This indicates the need for remedial teaching. To improve the achievements, the implementation of a three-level differentiated instruction model was proposed. The research method used was an experimental hypothesis test with a t-test. The research design was as follows: $y_1 \times y_2$, where y_1 is the initial condition, x represents the treatment process, and y_2 is the condition after the treatment. The results of the study showed that, after the intervention, the average final test score was 84.62, and 26 students (84%) met the minimum passing criteria. The t-test results indicated a t-value of 6.72 and a critical t-value of 2.04. Since the t-value is greater than the critical t-value, the three-level differentiated instruction model (X) has a positive impact on improving students' performance in badminton (Y). The three-level differentiated learning model can be applied to other subjects with different characteristics, such as mathematics, physics, social sciences, and other disciplines, based on the relevant theoretical framework.

KEYWORDS

Learning; Differentiated Instruction; Three-Level; Achievement; Badminton

1. INTRODUCTION

Physical Education (PE) is expected to promote a healthy lifestyle, improve physical quality, and provide students with the knowledge necessary to understand and properly practice sports (Lynch & Soukup, 2016; Wintle, 2022). When conducted with enthusiasm, proper training in sports, significantly benefits adolescent growth, even though there are risks, such as sprains or broken bones. Therefore, students must adhere to their teacher's instructions and be disciplined. To improve student achievement, teachers must be innovative in their teaching methods to ensure students do not get bored with their training. It is crucial to incorporate variety, as students require new challenges to stay engaged. The teacher's role is to design comprehensive physical education lessons that target the core goals of the subject, which include developing psychomotor, affective, and cognitive skills (Pitnawati et al., 2023; Saharullah et al., 2024; Umar et al., 2023). In PE learning, there is badminton material, badminton is a sport played by two players (in singles) or two pairs of players (in doubles) who attempt to hit the shuttlecock with a racket in order to pass the net and land on the opponent's court (Cabello-Manrique et al., 2022; Liu et al., 2023; Negara et al., 2024; Riza et al., 2018). The sport has a variety of basic techniques, including serve, drive, clear, smash, and net shot, each of which requires specific skills and regular practice (Hidayat et al., 2022; Krishnaram et al., 2024).

Badminton is also popular as a recreational and social activity that is played in many countries around the world. One of the efforts to preserve the sport of Badminton is through learning at school. Badminton sports subjects are included in the national curriculum and are compulsory (Hanifa, 2019). The integration of Badminton skills into the school curriculum is urgently needed so that students have a love for the sport of Badminton. Starting from this love, it is hoped that students will have an interest in practicing and making choices of Badminton as a hobby as well as personal career development. Sports learning with the direction of the teacher with the goals that have been set in the curriculum. PE in schools can improve students' psychomotor, cognitive, and emotional performance Students who exercise diligently under the direction of teachers or coaches can have superior character than students who do not take part in these lessons (Mardius et al., 2025; Pitnawati et al., 2023).

Continuous efforts should be made through various strategies to ensure students enjoy and are willing to engage in learning, without external pressure. One of the strategies for teaching badminton in schools is the implementation of three-level differentiated teaching. In this approach, teachers must understand the needs, interests, learning styles, and skill levels of each student in their class. This approach allows teachers to design a learning experience that aligns with each student's individual

needs (Schwartz et al., 2023; Spires et al., 2012). The core concept of different teaching is to tailor learning to meet the diverse needs of each student. Teachers need to consider different student competencies and offer a different approach for each student in the classroom. By offering personalized learning experiences that accommodate a wide range of students' needs, interests, and abilities—including their individual characteristics—the achievement of learning competencies can be further optimized (Khor & K, 2024). The principle behind different teaching is that all students should be able to reach their full learning potential effectively. If teachers improve their understanding of students and the content they teach, it becomes possible for them to adopt flexible teaching methods. This concept recognizes that every student is unique and requires a different approach to learning. PE as part of motor-based learning, also benefits from such differentiation. Another advantage of this model is that it fosters self-organization among students, motivating them to take responsibility for their learning (Leukel & Loibl, 2025; Susaki, 2021).

These efforts must be continued, especially considering the low badminton performance among students. The real situation in the badminton skill test for 8th-grade students at Junior High School (JHS) 2 Sleman shows disappointing results. The average score of a sample of 31 students was only 66.83, far from the target of 80, as outlined in the school's Medium-Term Work Plan. Individually, only 3 students out of 31 were able to reach the minimum target score of 80. This low individual achievement suggests that the teaching methods employed by the teacher may be problematic. According to the school's curriculum, a lesson is considered successful and can progress to the next topic if 85% of the students achieve the target, and the class average reaches at least 80. However, neither the individual achievements nor the class average met the required targets. This data suggests a failure in the teaching process. Potential factors contributing to this failure include the teacher's choice of an ineffective teaching strategy, inadequate learning resources, and a generalized approach to students despite their varied competencies, talents, and interests. Therefore, this research aims to examine whether differences in instructional approaches, particularly through differentiated instruction, can have a significant positive impact on the development of students' badminton skills.

2. METHODS

2.1. Design and Participants

The research method used is an experimental design with a one-group pre-test post-test design. The researcher conducts an initial measurement (pre-test) to collect data before the intervention, then implements differentiated learning with three levels to the students, followed by a post-test to measure the results after the intervention. The sample for this study consists of 31 students from 8th grade at JHS 2 Sleman.

2.2. Instruments and Procedures

The research is conducted over two months, from February to March 2024. The independent variable (x1) in this study is the three-level differentiated learning, while the dependent variable (y) is the students' badminton performance. The research process begins with preparation, which includes scheduling and designing the learning plan, followed by a diagnostic test to categorize students based on their level of mastery (level 1, level 2, level 3). The learning process is then carried out in accordance with the principles of differentiated instruction, where students receive treatments based on their individual competencies. In the final stage, assessments are conducted to evaluate badminton skills, including basic techniques, stroke techniques, and game performance.

2.3. Statistical Analyses

The collected data were analyzed using paired-sample t-tests to examine differences between the pre-test and post-test results. When the calculated t-value exceeded the critical value from the t-distribution table at the .05 significance level ($p < .05$), the null hypothesis (H_0) was rejected, indicating that three-level differentiated instruction had a significant effect on improving students' badminton performance. Data analyses were conducted using the Statistical Package for the Social Sciences (SPSS), version 25.

3. RESULTS

Based on the data from the results of the initial (diagnostic) assessment with the final assessment after students were given the treatment of the 3-level differential learning model, it showed an increase in student learning achievement. This increase can be an indicator that the differentiated learning model has a positive impact. The difference between the results of the initial assessment and the final assessment after students are given treatment can be seen in the following table:

Table 1. Comparison table of the results of the initial assessment and the final assessment

No	Activity	Initial	Final	Progress	Remarks
1	Number of Students	31	31	0	Sample size remains the same
2	Average Score	66.83	84.62	+17.79	Improvement
3	Number of Students Meeting KKM	5	26	24	Improvement
4	Number of Students Failing	26	5	-21	Progress of students succeeding
5	Learning Mastery Percentage	9%	84%	75%	Improvement

The table above shows an increase in student learning achievement, where in the initial assessment (diagnostic test) classically only reached an average of 66.83, while in the final assessment it reached 84.62. In the achievement of the average score, learning outcomes increased by 17.79. The number of students who managed to reach KKM increased from 4 people to 26 people. The percentage of learning completion increased from 9% to 84%. A very significant impact occurred on the process of classical learning completeness. The limit of material mastery that is eligible to continue is 75% so that the achievement of the implementation of 3-level decentralized learning can exceed the minimum standard. Based on the results of the t-test of one paired sample to prove whether the variables y_1 and y_2 are the same or different, if they are the same, then the hypothesis H_0 is accepted and H_1 stating that y_1 and y_2 are not the same is rejected. If the t-test results show that y_1 and y_2 are different, then H_1 is accepted and H_0 is rejected. In this study, another t-test method is also used, namely using a probability value with a provision, if the alpha value is less than the probability value, H_1 is accepted and H_0 is rejected, meaning that the implementation of the 3-level differential learning model has an impact on improving the achievement of junior high school students in badminton. The t-test results are presented in Table 2. The results show that the t-test value (t-hit) is 6.720675262, the t-table value (t-table) is 2.04227456, and the alpha value is 0.00000019.

Table 2. Impact of the 3-level differential learning model on student achievement: paired sample t-test results

Statistic	Final (KE-2)	Initial
Mean	84.62	66.83
Variance	87.64	233.28.00
Observations	31	31
Pearson Correlation	00.36	
Hypothesized Mean Difference	0	
df	30	
t Stat	0,3	
P(T<=t) one-tail	9.49E-08	
t Critical one-tail	0,09027778	
P(T<=t) two-tail	0.00000019	
t Critical two-tail	02.04	

Model 1: H0 is rejected, and H1 is accepted if $t_{hit} > t_{table}$. The t-test result in the table shows $6.720675262 > 2.04227456$. Since t_{hit} is greater than t_{table} , H0 is rejected, and H1 is accepted, which means that the three-level differentiated learning model has a significant impact on improving the badminton performance of JHS students.

Model 2: H0 is rejected, and H1 is accepted if the alpha value is less than the probability value. The t-test result in the table shows that the alpha value, 0.00000019, is less than 0.05. This result proves that H0 is rejected, and H1 is accepted. Therefore, this confirms that the results of y_1 and y_2 are significantly different.

4. DISCUSSION

The purpose of this research was to investigate the effectiveness of three-level differentiated learning in improving the badminton performance of students at JHS 2 Sleman. The results indicated a significant improvement in students' learning outcomes, which underlines the importance of exploring innovative teaching strategies to address existing challenges in PE, particularly in sports like badminton. This research is crucial because it highlights a significant issue in the current educational approach to PE. At JHS 2 Sleman, the initial badminton performance of students was below expectations, with only 9% of students meeting the minimum learning standard of 80. This indicates a gap in student achievement and suggests that traditional teaching methods might not be sufficient in addressing the diverse learning needs of students.

The introduction of a differentiated teaching model, especially one that accommodates students' varying skills, interests, and learning styles, can provide a more tailored approach to improving their performance. By investigating the effectiveness of three-level differentiated learning, this study offers valuable insights into how adaptive teaching methods can lead to substantial improvements in students' athletic abilities, particularly in a sport that demands precision and technique, such as badminton. Several studies have explored the impact of differentiated teaching methods in physical education. For instance, Halil et al. (2024) examined the effects of differentiated instruction on student engagement and achievement in various subject areas. Their research found that differentiation leads to improved student outcomes by catering to individual learning styles and abilities. Similarly, Akabruddin et al. (2024) highlighted the effectiveness of differentiated instruction in PE, noting that tailoring lessons to the students' needs fosters greater engagement and performance. Hidayat et al. (2023) studied the effect of instructional strategies on badminton performance and emphasized the role of tailored teaching methods in developing students' fundamental skills. Their findings are consistent with the results of this study, as they showed that students who received instruction aligned with their specific abilities demonstrated a significant improvement in their performance. Additionally, a study by Nasution et al. (2024) explored how differentiated learning in badminton training positively impacted students' mastery of basic techniques, which was a key focus in this research as well.

The findings of this study are in line with these previous studies, confirming that differentiated teaching methods, such as the three-level approach used in this study, can have a significant positive impact on student achievement in sports. The comparison underscores the importance of adapting teaching strategies to individual needs in order to optimize learning outcomes, particularly in physical education. The results of this study have several important implications for the field of physical education. First, the significant improvement in students' badminton performance demonstrates that differentiated teaching can effectively address the diverse needs of students. By tailoring lessons to students' skill levels, teachers can ensure that each student receives the appropriate level of challenge and support, leading to better outcomes. This approach not only enhances students' technical skills but also motivates them to remain engaged in learning, which is crucial for long-term development. Moreover, the study suggests that differentiated learning can help increase students' interest in sports, particularly badminton, by providing a more personalized and enjoyable learning experience. Given that badminton is part of the national curriculum and has the potential to foster lifelong participation in physical activity, this research highlights the

importance of incorporating differentiated teaching strategies into school curricula to cultivate a passion for sports. Future research should explore the long-term effects of three-level differentiated learning on student performance in other sports. While this study focused on badminton, it would be valuable to investigate whether the same approach could be applied to other physical activities, such as soccer, basketball, or athletics. Additionally, further studies could examine the impact of differentiated learning on other aspects of student development, such as teamwork, leadership, and emotional intelligence, which are critical components of sports education.

Another recommendation is to conduct research that compares the effectiveness of different differentiated teaching models in PE. For instance, investigating whether the three-level model is more effective than other models of differentiation (e.g., based on interests or learning styles) could provide deeper insights into the most effective approaches for improving student performance. Moreover, it would be useful to explore the perspectives of teachers and students regarding the implementation of differentiated learning, as this could inform the development of more effective teacher training programs. Finally, research could be conducted to examine the scalability of this model across different schools and educational settings. Understanding how to implement and adapt three-level differentiated learning in various contexts—such as different grade levels, school sizes, or cultural settings—would help determine the generalizability of the findings and further promote the widespread adoption of this teaching strategy in physical education. In conclusion, this study provides valuable evidence supporting the effectiveness of three-level differentiated learning in improving students' badminton performance. By comparing the results with previous research, it is clear that personalized teaching strategies can significantly enhance student outcomes in PE. The findings highlight the need for innovative, student-centered approaches in education and suggest that further research in this area can contribute to the development of more effective teaching practices in physical education.

5. CONCLUSIONS

Based on the results and discussion, it can be concluded that the 3-level differential learning implemented to 31 8th grade students of JHS 2 Sleman, has been proven to significantly improve the achievement of badminton playing skills. There was a difference between the initial condition before the treatment and the final condition after the treatment. The results of the analysis of the t-test test prove that the hypothesis that the 3-level differential learning model can significantly increase student achievement in playing badminton. This success also adds a learning model and is ready to be implemented to improve student achievement. Following up on the results of this research, we

will develop in the next research with a larger number of samples, with the hope that the results are more valid and can be useful in a wider scope. This research can also be a model to improve the learning process, especially in sports subjects, but it is possible that it can be applied to other subjects. The three-level differentiated learning model can be applied to other subjects with different characteristics, such as Mathematics, Physics, Social Sciences, and other disciplines, based on the relevant theoretical framework.

6. REFERENCES

1. Akabruddin, A., Suherman, W. S., Komari, A., Hambali, S., Saputra, W., & Permana, M. F. (2024). The Utilization of Differentiated Learning in Improving Physical Fitness and Active Lifestyle of Junior High School Students: Literature Review in Physical Education. *Pamukkale Journal of Sport Sciences*, 15(3), 561–577. <https://doi.org/10.54141/psbd.1512748>
2. Cabello-Manrique, D., Lorente, J. A., Padiál-Ruz, R., & Puga-González, E. (2022). Play Badminton Forever: A Systematic Review of Health Benefits. *International Journal of Environmental Research and Public Health*, 19(15), 1-21. <https://doi.org/10.3390/ijerph19159077>
3. Halil, N. I., Yawan, H., Hasanah, A. N., Syam, H., Andas, N. H., & Marhamah. (2024). A New Program to Foster Inclusion: Unraveling Language Teachers' Pedagogical Practices to Differentiated Instruction. *International Journal of Language Education*, 8(2), 370–383. <https://doi.org/10.26858/ijole.v8i2.64997>
4. Hanifa, A. M. (2019). Design Efficiency for Badminton Training Building at West Java Sport Science Training Center. *IOP Conference Series: Earth and Environmental Science*, 248(1), 1-11. <https://doi.org/10.1088/1755-1315/248/1/012033>
5. Hidayat, Y., Yudiana, Y., Hambali, B., & Nugraha, R. (2022). Reliability and Factorial Validity of Badminton Basic Skill among Badminton Beginner Athletes: A Preliminary Study. *International Journal of Human Movement and Sports Sciences*, 10(5), 922–931. <https://doi.org/10.13189/saj.2022.100508>
6. Hidayat, Y., Yudiana, Y., Hambali, B., Sultoni, K., Ustun, U. D., & Singnoy, C. (2023). The effect of the combined self-talk and mental imagery program on the badminton motor skills and self-confidence of youth beginner student-athletes. *BMC Psychology*, 11(1), 1–16. <https://doi.org/10.1186/s40359-023-01073-x>
7. Khor, E. T., & K, M. (2024). A Systematic Review of the Role of Learning Analytics in Supporting Personalized Learning. *Education Sciences*, 14(1), 1-18. <https://doi.org/10.3390/educsci14010051>
8. Krishnaram, N., Ahamed, J., Sathyamoorthy, N., Sandaruwan, K. D., & Athapaththu, A. M. K. B. (2024). Skeletal point analysis to determine the accuracy of forehand smash shots played by badminton players. *Journal of the National Science Foundation of Sri Lanka*, 52(1), 125–142. <https://doi.org/10.4038/jnsfsr.v52i1.12141>
9. Liu, W., Zhu, Y., Guo, W., Wang, X., & Yu, S. (2023). Gaming Tree Based Evaluation Model for Badminton Tactic Benefit Analysis and Prediction. *Applied Sciences*, 13(13), 1-13. <https://doi.org/10.3390/app13137380>
10. Lynch, T., & Soukup, G. J. (2016). Physical education, “health and physical education”, “physical literacy” and “health literacy”: Global nomenclature confusion. *Cogent Education*, 3(1), 1-22. <https://doi.org/10.1080/2331186X.2016.1217820>

11. Mardius, A., Sofyan, D., Hadi, R. S., Barlian, E., Ihsan, N., Astuti, Y., & Ockta, Y. (2025). Effectiveness of interval training in increasing VO₂max in pencak silat athletes. *SPORT TK-EuroAmerican Journal of Sport Sciences*, 14, 1–13. <https://doi.org/10.6018/spork.643791>
12. Nasution, N. S., Pelana, R., Yusmawati, & Fauzi, D. (2024). Machine Learning-Based Badminton Basic Technique Training Model. *International Journal of Human Movement and Sports Sciences*, 12(6), 1023–1031. <https://doi.org/10.13189/saj.2024.120614>
13. Negara, J. D. K., Nuryadi, N., Firmansyah, H., Gumilar, A., Hambali, B., Purnomo, E., Festiawan, R., & Ockta, Y. (2024). The effect of vo₂max on muscle oxygen saturation (SMO₂) in University Badminton Athletes. *Retos*, 61, 1184–1190. <https://doi.org/10.47197/retos.v61.108861>
14. Pitnawati, Damrah, Handayani, S. G., Putra, A. N., Sasmitha, W., Nelson, S., Wulandari, I., Angelia, L., Ningsih, M. S., & Ockta, Y. (2023). Development of direct and indirect assistance approach using jigsaw method and android-based digital design method for gymnastic materials. *Journal of Physical Education and Sport*, 23(12), 3292–3298. <https://doi.org/10.7752/jpes.2023.12376>
15. Riza, L. S., Firmansyah, M. I., Siregar, H., Budiana, D., & Rosales-Pérez, A. (2018). Determining strategies on playing badminton using the Knuth-Morris-Pratt algorithm. *Telkonnika*, 16(6), 2763–2770. <https://doi.org/10.12928/TELKOMNIKA.v16i6.11554>
16. Saharullah, Wahyudin, Idrus, N. A., & Ockta, Y. (2024). Application of combination of physical training methods to improve the aerobic capacity of football players. *SPORT TK-EuroAmerican Journal of Sport Sciences*, 13, 1–8. <https://doi.org/10.6018/spork.637341>
17. Schwartz, E., Shamir-Inbal, T., & Blau, I. (2023). Teacher prototypes in technology-enhanced instruction in elementary school second language acquisition: Comparing routine and emergency learning in different cultures. *Computers and Education Open*, 5(2), 1-15. <https://doi.org/10.1016/j.caeo.2023.100155>
18. Spires, H. A., Hervey, L. G., Morris, G., & Stelpflug, C. (2012). Energizing project-based inquiry: Middle-grade students read, write, and create videos. *Journal of Adolescent and Adult Literacy*, 55(6), 483–493. <https://doi.org/10.1002/JAAL.00058>
19. Susaki, Y. (2021). Self-regulated learning and motor skills: effects of a physical education intervention program on Japanese college students. *Journal of Physical Education and Sport*, 21(6), 3593–3598. <https://doi.org/10.7752/jpes.2021.06485>
20. Umar, Ockta, Y., & Mardesia, P. (2023). A Correlational Study: Pedagogical and professional competence of physical education teachers in relation to the implementation of the Merdeka curriculum. *Journal of Physical Education and Sport*, 23(12), 3325–3331. <https://doi.org/10.7752/jpes.2023.12380>
21. Wintle, J. (2022). Physical Education and Physical Activity Promotion: Lifestyle Sports as Meaningful Experiences. *Education Sciences*, 12(3), 1-10. <https://doi.org/10.3390/educsci12030181>

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CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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