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Design of an Inclusive Physical Education Model Based on Instructional Differentiation to Enhance the Active Participation of Students with Intellectual Disabilities

Pandu Kresnapati*[1], Setiyawan[2], Dani Slamet Pratama[3], Ibnu Fatkhu Royana[4]

[1,2,3,4] FPIPKR, Universitas PGRI Semarang, Indonesia

email: pandukresnapati@upgris.ac.id[1] , Setiyawan@upgris.ac.id[2] , danislametpratama@upgris.ac.id[3] , ibnufatkhuroyana@upgris.ac.id[4]

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Abstract

This study aims to develop and examine the effectiveness of an Inclusive Physical Education model based on instructional differentiation in enhancing the active participation of students with intellectual disabilities. The research employed a Research and Development (R&D) approach, involving stages of needs analysis, model design, expert validation, limited trials, revision, effectiveness testing, and finalization. The study was conducted in an inclusive primary school in Pekalongan Regency, involving 17 students with mild to moderate intellectual disabilities, physical education teachers, and experts in adaptive physical education. Data were collected through observation, questionnaires, interviews, and documentation, and analyzed using qualitative and quantitative techniques, including paired-sample t-tests. The results showed a significant improvement in students' active participation, motor engagement, and social interaction after the implementation of the model ($p < 0.05$). The average increase in scores across all variables exceeded 23 points, indicating a consistent and meaningful impact. The model also met the criteria of validity, practicality, and effectiveness, with homogeneous improvements across participants. In conclusion, the developed model is effective in improving the quality of inclusive physical education learning and can serve as an alternative approach for accommodating the diverse needs of students with intellectual disabilities. This study contributes to the advancement of adaptive physical education and supports the implementation of inclusive education practices.

Keywords: *Inclusive Physical Education, Instructional Differentiation,Intellectual Disabilities, Active Participation, Adaptive Learning*

Alamat Koresponden : Universitas PGRI Semarang, Indonesia
Email : pandukresnapati@upgris.ac.id

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INTRODUCTION

Inclusive education is a constitutional mandate that guarantees every citizen access to educational services without discrimination. The implementation of inclusive education in Indonesia is reinforced by the Ministry of Education Regulation No. 70 of 2009, which affirms that learners with special needs are entitled to a quality education that meets their needs and characteristics. This commitment is also aligned with the global Sustainable Development Goals (SDGs) agenda, specifically Goal 4, which emphasizes the importance of inclusive, equitable, and quality education for all. In this context, Physical Education, Sport and Health Physical Education, Sports, and Health. plays a strategic role in supporting the physical, social, emotional, and independent development of students with disabilities. In the 21st-century education landscape, exclusivity in physical education is not merely about providing facilities and equipment, but also about innovating teaching strategies that respond to the diverse needs of pupils. Teachers are expected to create a learning environment that is conducive, flexible, and fosters mutual respect, so that every pupil feels accepted and motivated to participate actively (Hasmyati, 2025).

Inclusive physical education (PE) is a fundamental aspect of education that aims to create an environment in which all pupils, regardless of their abilities or backgrounds, can participate, learn, and develop (Dubey, 2024). Conceptually, inclusive physical education emphasizes the full participation of all pupils in meaningful physical activities (Andi Fatwa, Haerul Ma'ruf, Hudain, Hasyim, & Alwi, 2025). However, the reality on the ground shows that pupils with intellectual disabilities still face barriers to participating fully in physical education lessons. The characteristics of intellectual disabilities, which include limitations in intellectual functioning and adaptive behaviour (Lubis et al., 2023) impact the ability to understand instructions, sustain attention, and coordinate movements effectively. This situation often results in low levels of active participation and motor engagement in learning activities.

The low participation of students with disabilities in physical education is often due to a lack of appropriate instructional adaptations. Physical education teachers still tend to use a 'one-size-fits-all' approach, which is insufficiently responsive to the diversity of students' abilities. In fact, the instructional differentiation approach emphasises the importance of adapting learning content, processes, and outcomes to students' readiness, interests, and learning profiles (Tomlinson, 2010). Intellectual disability causes difficulties with motor

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coordination and the process of learning new activities, meaning that an individual's motor development proceeds at a slower pace and affects their quality of life. Furthermore, individuals with intellectual disabilities generally demonstrate a lower ability to perform movements that integrate two or more activities (Özkan, 2023). In the context of adaptive physical education, differentiation can be achieved through modifications to game rules, variations in movement difficulty, the use of assistive devices, and alternative forms of assessment. Although the concept of instructional differentiation has been widely applied in academic learning, its implementation in adaptive physical education remains limited, particularly in inclusive schools in Indonesia. This situation highlights a gap between inclusive education policy and teaching practice in the field. Therefore, there is a need to design a model of Inclusive Physical Education based on instructional differentiation that is systematic, practical, and tailored to the characteristics of students with intellectual disabilities.

An intellectual disability (ID) is a condition characterized by significant limitations in intellectual functioning, such as thinking skills and general mental ability (IQ), as well as limitations in adaptive functioning, which encompasses the conceptual, social and practical skills required to carry out activities of daily living. This condition arises during an individual's developmental years (Mattie, Loveall, Channell, & Rodgers, 2023). Pupils with intellectual disabilities tend to have lower levels of physical participation than their peers without disabilities, particularly when teaching is not properly adapted (Johnston, 2024). Intellectual disability in children is characterized by intellectual functioning that is significantly below average for their age group, accompanied by limitations in adaptive behaviour that develop during childhood (Ma'rufatus et al., 2024). Children with intellectual disabilities (intellectual impairment) demonstrate intellectual abilities below the average, which affects their ability to carry out personal care independently. This situation leads to a high level of dependence on their families and increases the risk of social isolation within the community due to a lack of independence and poor personal hygiene (Hutzler, Meier, Reuker, & Zitomer, 2019).

METHOD

This study employs a Research and Development (R&D) approach, utilizing a development model (Singh, 2022) that has been modified to suit the requirements of the research. This approach was selected because the study aims to produce an "Inclusive

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Physical Education" learning model—based on instructional differentiation—that is validated and tested for its effectiveness. The research was conducted at an inclusive primary school providing services for pupils with intellectual disabilities in the Pekalongan Regency. The research subjects consisted of: 1) Physical Education teachers at the inclusive school, 2) Students with intellectual disabilities (mild–moderate), 3) Experts in adaptive physical education and inclusive education (for expert validation). The sampling technique used was purposive sampling, taking into account schools with students with intellectual disabilities who were actively participating in Physical Education lessons.

Model development began with a needs analysis through literature reviews, observations, and interviews/focus group discussions (Sugiyono, 2019). The design phase involved the development of learning syntax, teaching materials, and differentiation strategies (content, process, product, and learning environment) to produce a prototype. Expert validation was carried out to assess the model's feasibility, followed by revisions and a pilot study to determine its practicality.

Effectiveness testing utilized a quasi-experimental design with a pretest–post test control group design involving experimental and control groups. The independent variable was the learning model, the dependent variable was student active participation, and supporting variables included motor engagement and social interaction. Data collection was carried out through observation, questionnaires, interviews/FGDs, and documentation. The instruments were tested for content validity and reliability. Data analysis utilized qualitative and quantitative techniques, including tests of normality, homogeneity, paired-sample t-tests, independent-sample t-tests, and effect size at a significance level of $\alpha = 0.05$. The model was deemed feasible if it met the criteria of validity (≥80%), practicality (≥80%), and effectiveness, as demonstrated by a significant increase ($p < 0.05$) with an effect size of at least moderate.

RESULT

The results of this study present findings regarding the effectiveness of an Inclusive Physical Education model based on instructional differentiation in enhancing the active participation of students with intellectual disabilities in Physical Education lessons. Data were collected using a pretest–post-test design involving 17 students, covering active

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participation, motor engagement, and social interaction. Overall, the results indicate an improvement in all variables following the implementation of the developed learning model.

. **Table 1.** Student Active Participation (Score 1–100)

No	Pretest	Posttest	Difference
1	52	75	23
2	50	73	23
3	48	70	22
4	55	78	23
5	51	74	23
6	49	72	23
7	54	77	23
8	53	76	23
9	47	69	22
10	56	80	24
11	50	73	23
12	49	72	23
13	51	74	23
14	48	71	23
15	47	70	23
16	52	75	23
17	53	77	24
Average	**50,9**	**74,1**	**+23,2**

Based on the data in the table, there is a clear increase in students' active participation scores between the pretest and post-test. Pretest scores ranged from 47 to 56, whilst post-test scores rose to between 69 and 80. The difference in improvement for each student was relatively consistent, ranging from 22 to 24 points.

Overall, the average pretest score of 50.9 increased to 74.1 in the post test, with an average increase of 23.2 points. This data indicates that almost all students experienced a significant improvement after the intervention. The consistency of the relatively homogeneous score differences also indicates that the learning model applied had an even impact on all research subjects.

Table 2. Motor Involvement (Score 1–100)

No	Pretest	Posttest	Difference
1	55	78	23
2	53	76	23
3	50	73	23
4	57	80	23
5	54	77	23
6	52	75	23
7	56	79	23

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8	55	78	23
9	49	72	23
10	58	82	24
11	53	76	23
12	52	75	23
13	54	77	23
14	51	74	23
15	50	73	23
16	55	78	23
17	56	80	24
Average	**53,5**	**77,1**	**+23,6**

Based on the data in the table, there was an increase in pupils' motor engagement scores between the pretest and post-test. Pretest scores ranged from 49 to 58, whilst post-test scores increased to between 72 and 82. The difference for each pupil showed a consistent improvement, ranging from 23 to 24 points.

The average pretest score of 53.5 increased to 77.1 in the post test, with an average increase of 23.6 points. This indicates that all students experienced improved motor engagement following the implementation of the learning model. The consistency of the relatively homogeneous difference values suggests that the intervention had an even impact on all research subjects.

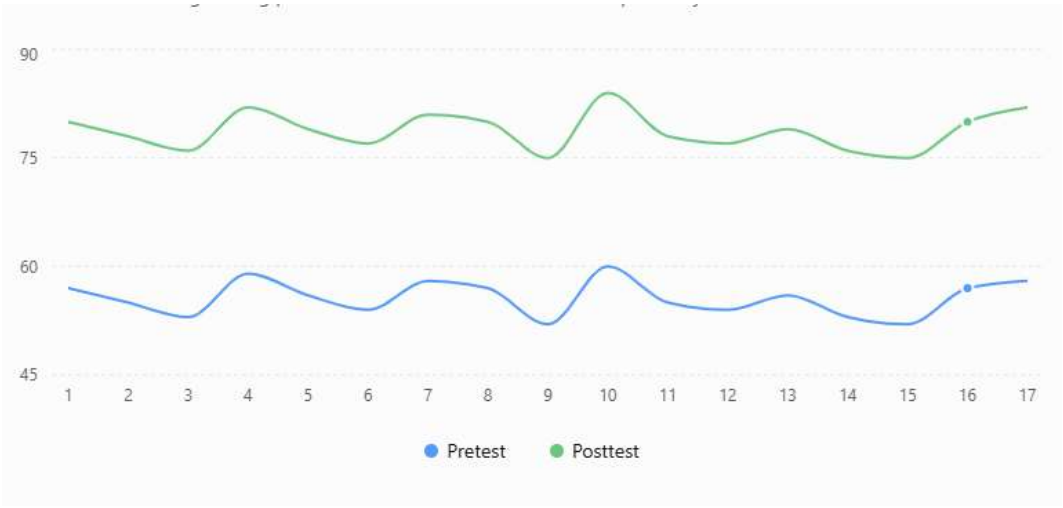
The results of the paired-samples t-test showed that the increase was significant ($p < 0.05$), indicating a significant difference between the pretest and post-test scores. Thus, the learning model implemented proved effective in improving students' motor engagement.

Table 3. Social Interaction (Score 1–100)

No	Pretest	Posttest	Difference
1	57	80	23
2	55	78	23
3	53	76	23
4	59	82	23
5	56	79	23
6	54	77	23
7	58	81	23
8	57	80	23
9	52	75	23
10	60	84	24
11	55	78	23
12	54	77	23
13	56	79	23
14	53	76	23

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15	52	75	23
16	57	80	23
17	58	82	24
Average	**55,8**	**79,2**	**+23,4**



Based on the data in the table, there was an increase in students' social interaction scores between before (pretest) and after (post-test) the intervention. Pretest scores ranged from 52 to 60, whilst post-test scores increased to between 75 and 84. The difference in improvement for each student was relatively consistent, ranging from 23 to 24 points.

The average pretest score of 55.8 increased to 79.2 in the post test, with an average increase of 23.4 points. This indicates that all students experienced improved social interaction following the implementation of the learning model. The consistency of the homogeneous difference values suggests that the intervention had an even impact on all research subjects. The results of the paired-samples t-test showed that the increase was significant ($p < 0.05$), indicating a significant difference between the pretest and post-test scores. Thus, the learning model implemented proved effective in improving students' social interaction.

DISCUSSION

The findings of this study demonstrate that the Inclusive Physical Education model based on instructional differentiation significantly improves students' active participation, motor engagement, and social interaction. This is evidenced by the consistent increase in all measured variables, with an average improvement of more than 23 points across

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indicators, as well as statistically significant results ($p < 0.05$). These findings indicate that the developed model is not only effective but also has a strong and consistent impact on students with intellectual disabilities.

The increase in active participation suggests that instructional differentiation enables students to engage more meaningfully in learning activities. This finding is in line with the concept proposed (Zens, 2021), which emphasizes that learning should be adapted to students' readiness, interests, and learning profiles. In the context of physical education, such adaptations allow students with intellectual disabilities to better understand instructions, remain focused, and actively participate in activities that match their abilities. The study by (Dakopolos et al., 2024) evaluated the influence of non-verbal cognition, measured using the Learning Scale, on the initial level (intercept) and rate of development (slope) of various adaptive behaviour sub scales in children with Fragile X Syndrome (FXS), who were observed three to six times between the ages of 2 and 10 years. The results of the study showed that non-verbal cognition significantly predicted the rate of development of daily living skills and motor skills. Furthermore, non-verbal cognition was also found to be a significant predictor of baseline levels of socialization, communication, and motor skills.

Furthermore, the significant improvement in motor engagement indicates that the modification of learning activities, including adjustments in task difficulty and the use of adaptive strategies, contributes positively to students' physical involvement. This supports previous findings that adaptive physical education can enhance the motor participation of students with disabilities when learning activities are designed to accommodate individual differences (Protic-Gava, Boskovic, Smajic, Simic-Panic, & Naumovic, 2018). The relatively homogeneous increase across students also suggests that the model provides equitable learning opportunities.

In terms of social interaction, the results show that the implementation of the model fosters improved interaction among students. This finding high-lights that differentiated instruction not only addresses cognitive and motor aspects but also supports social development. Engaging students in inclusive and collaborative physical activities encourages communication, cooperation, and mutual respect, which are essential components of inclusive education (Evaggelinou, 2025). This is consistent with previous

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research indicating that participation in structured physical activities can enhance the social skills of students with special needs.

The very large effect size found in this study further confirms the strong impact of the developed model. Although the N-Gain falls within the moderate category, it still indicates meaningful practical improvement in the learning process. These results suggest that the model is highly effective in addressing the limitations of conventional "one-size-fits-all" approaches commonly used in physical education.

Overall, this study reinforces the importance of implementing instructional differentiation in inclusive physical education settings. The developed model provides a practical and systematic framework for teachers to design adaptive learning experiences that accommodate diverse student needs. In line with inclusive education policies and the Sustainable Development Goals (SDGs), this approach contributes to creating equitable and meaningful learning opportunities for all students, particularly those with intellectual disabilities.

CONCLUSION

This study concludes that the Inclusive Physical Education model based on instructional differentiation is effective in improving the active participation of students with intellectual disabilities in physical education learning. The findings indicate significant increases in active participation, motor engagement, and social interaction, as evidenced by consistent score improvements and statistically significant results ($p < 0.05$). The developed model has been proven to meet the criteria of validity, practicality, and effectiveness, with a strong impact on all research subjects. Instructional differentiation enables the adaptation of learning processes according to students' characteristics, thereby creating a more inclusive, equitable, and meaningful learning environment.

Therefore, this model can be used as an alternative approach in implementing inclusive physical education, particularly in accommodating the diverse needs of students with intellectual disabilities and enhancing the overall quality of learning in inclusive

IMPLICATION

The findings of this study have several important implications in theoretical, practical, and policy contexts. Theoretically, this study strengthens the concept of inclusive

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physical education and instructional differentiation as an effective approach in improving student participation, particularly for students with intellectual disabilities. The results provide empirical evidence that differentiation strategies can be successfully applied in physical education settings, thereby enriching the body of knowledge in adaptive physical education and inclusive learning.

Practically, the developed model offers a structured and applicable framework for physical education teachers in inclusive schools. Teachers can utilize this model as a guideline to design and implement learning activities that are more adaptive to students' abilities, interests, and learning characteristics. This approach not only enhances student engagement but also supports the creation of a more inclusive, supportive, and student-centred learning environment.

From a policy perspective, the results of this study support implementing inclusive education policies in Indonesia, particularly in the context of physical education. The model aligns with national education regulations and the Sustainable Development Goals (SDGs), particularly in promoting equitable, high-quality education for all learners. Therefore, policymakers and educational stakeholders are encouraged to integrate instructional differentiation into curriculum development, teacher training programs, and inclusive education practices to improve the overall quality of education in inclusive schools.

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