



Small Ball Games as a Motor Skill Intervention for Students with Moderate Intellectual Disability

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ABSTRACT

Purpose of the study: This study aims to examine the effectiveness of small ball games as a physical education intervention for improving motor skills among students with moderate intellectual disability in an Indonesian special needs school setting.

Methodology: This study employed a Classroom Action Research (CAR) design consisting of two cycles conducted with eight Grade III students with moderate intellectual disability at SLB Negeri Kendal, Central Java. Data were collected through motor performance tests, participatory observation, documentation, and teacher interviews. Data validity was established using triangulation techniques, while learning achievement was evaluated based on individual and classical mastery criteria.

Main Findings: The findings showed progressive improvement in students' motor skills across both action research cycles. Mean motor performance scores increased from baseline to Cycle 1 and further improved in Cycle 2, while classical completion rates exceeded the established mastery target. Observational results also confirmed enhancement in running and walking command comprehension, ball catching, and ball bouncing abilities through structured small ball game activities.

Novelty/Originality of this study: This study demonstrates the effectiveness of small ball games as an adaptive and low-cost intervention for enhancing motor development in students with moderate intellectual disability. The research provides a practical and replicable play-based instructional model for adapted physical education in Indonesian special needs schools, emphasizing sequential and command-based motor learning strategies.

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1. INTRODUCTION

Intellectual disability (ID), internationally defined as significantly below-average intellectual functioning ($IQ \leq 70$) accompanied by deficits in adaptive behaviour manifesting during the developmental period, represents one of the most prevalent neurodevelopmental conditions worldwide, affecting approximately 1–3% of the global population [1], [2]. Within the Indonesian educational system, students with ID are categorised according to severity: mild ID (tunagrahita ringan, $IQ 50-70$), moderate ID (tunagrahita sedang, $IQ 25-50$), and severe ID

(tunagrahita berat, $IQ < 25$), each served by dedicated special needs schools (Sekolah Luar Biasa/SLB) whose curricula are adapted to the unique developmental profiles of their students (Undang-Undang No. 20 Tahun 2003).

Students with moderate ID present a particularly complex profile of motor challenges. Unlike their peers with mild ID, who may demonstrate near-typical gross motor development, individuals with moderate ID exhibit clinically significant deficits across multiple motor domains: impaired locomotor skills (running gait abnormalities, reduced running speed, compromised balance), deficient manipulative skills (ball catching, throwing, bouncing), and compromised fine motor coordination the last of which is especially consequential for activities of daily living such as self-care, writing, and tool use [3], [4]. These motor deficits are not merely peripheral to the condition; they exacerbate cognitive and social developmental delays by limiting the child's capacity to explore and interact with the environment in ways that normally stimulate learning and development [5], [6].

The neurobiological underpinnings of motor deficit in moderate ID are multifactorial [7], [8]. Depending on aetiology which may include chromosomal anomalies (Down syndrome being the most common single cause), perinatal injury, metabolic disorders, or postnatal insults such as febrile seizures and meningitis students with moderate ID show varying degrees of cerebellar hypoplasia, reduced myelination of motor tracts, and cortical dysconnectivity in fronto-cerebellar circuits that govern motor planning, execution, and feedback processing [9], [10]. These neurological differences produce the characteristic hypotonicity, slow reaction time, and difficulties with motor sequencing that are frequently observed in clinical and educational settings [11], [12].

Physical education (PE) and structured physical activity represent evidence-based strategies for addressing motor deficits in students with ID [13], [14]. Systematic reviews and meta-analyses have consistently documented that regular participation in structured motor activities ranging from aquatic therapy to dance, martial arts, and ball games produces significant improvements in balance, coordination, locomotion, and manipulative skills in children and adolescents with ID [15], [16]. The therapeutic mechanisms are both neurological exercise-induced neuroplasticity, increased BDNF expression, improved dopaminergic signalling and behavioural, as structured physical activities provide repeated, graduated practice opportunities that consolidate motor engrams through procedural memory pathways that are relatively preserved in individuals with ID compared to declarative memory systems [17], [18].

Small ball games a category encompassing activities involving small balls (tennis balls, rubber balls) used in throwing, catching, bouncing, and relay activities offer a particularly accessible modality for motor skill intervention in special needs schools [19], [20]. The multisensory stimulation provided by ball games (visual tracking, proprioceptive feedback from catching and throwing, auditory cues from ball impact) engages multiple sensory-motor integration pathways simultaneously, making them highly appropriate for the distributed motor deficits characteristic of moderate ID [21], [22]. Moreover, ball games naturally incorporate the verbal command-response structure that is central to the Indonesian SLB physical education curriculum, creating pedagogical coherence between intervention design and curricular requirements.

Despite the theoretical rationale and international evidence base for play-based physical activity in ID populations, the specific application of small ball games as a motor skill intervention within the Indonesian SLB context has received minimal systematic investigation [23], [24]. Most existing Indonesian research in this area has focused on children with mild ID or has adopted single-case experimental designs without formal cycle-based reflection. There is therefore a clear evidence gap regarding the effectiveness of structured small ball game protocols implemented within the Classroom Action Research (CAR) framework that is standard practice in Indonesian educational research for improving motor skills in students with moderate ID. The present study addresses this gap directly [25], [26].

The primary research question was: Can structured small ball game activities integrated into physical education improve motor skills in Grade III moderate ID students at SLB Negeri Kendal, as measured by performance test scores and observational data across two CAR cycles? The study additionally aimed to document the specific motor skill gains across four observational indicators (understanding running commands, understanding walking commands, ball catching, ball bouncing), and to identify pedagogical refinements that optimised outcomes between cycles.

2. RESEARCH METHOD

2.1 Type of Research

This study employed a Classroom Action Research (CAR) design following the Kemmis and Taggart cyclical model, comprising two complete cycles each consisting of four sequential phases: (1) Planning (Perencanaan), (2) Action Implementation (Pelaksanaan Tindakan), (3) Observation (Observasi), and (4) Reflection (Refleksi). CAR was selected as the methodological framework because it directly addresses practical educational problems within authentic classroom contexts and enables iterative improvement of instructional strategies based on systematic data collection and reflective analysis a design particularly appropriate when the research objective is to document and optimise a pedagogical intervention in a specific school setting [27].

2.2 Population and Sample

The study was conducted at SLB Negeri Kendal, Central Java, Indonesia. The population consisted of all students with moderate intellectual disability enrolled at the school. The sample was selected using total sampling, involving all eight Grade III students with moderate intellectual disability (Class IIIC). The participants consisted of six male students (RON, RZ, UD, WW, FQ, and ML) and two female students (RN and OP), all of whom had been formally diagnosed with moderate intellectual disability (IQ range 25–50) according to school records. Permission to conduct the study was obtained from the school administration, and informed consent was secured from the students' parents or guardians prior to data collection.

2.3 Data Collection Technique

Data were collected using multiple techniques to ensure comprehensive assessment of students' motor skill development. The primary instrument was a motor performance test (tes perbuatan), which measured students' ability to understand verbal commands, perform locomotor movements, and execute small ball game activities. The assessment employed a hierarchical scoring rubric ranging from 0 to 10 points.

Motor skill assessment used a performance test comprising five scored indicators evaluated using a hierarchical scoring rubric (Table 1) with maximum score 10.0. The test was administered at baseline (pre-intervention), post-Cycle 1, and post-Cycle 2. The five indicators were assessed progressively: (1) does not understand any command (score = 0); (2) understands the verbal command for running/walking (score = 2.5); (3) performs the movement after the command (score = 5.0); (4) can walk and run correctly (score = 7.5); (5) can perform small ball game activities (score = 10.0). The scoring logic was hierarchical achievement at level *n* implied mastery of all preceding levels.

Table 1. Motor Skill Assessment Rubric: Small Ball Game Performance Indicators

Level	Motor Skill Indicator	Score	KKM Status
0	Does not understand any verbal command given by teacher	0	Not Mastered
1	Understands verbal commands (running/walking aba-aba)	2.5	Not Mastered
2	Performs movement after hearing the verbal command	5.0	Not Mastered
3	Correctly walks and runs on command (locomotor skill)	7.5	Mastered (≥ 7.0)
4	Performs complete small ball game (catching + bouncing/dribbling)	10.0	Mastered (≥ 7.0)

KKM (Kriteria Ketuntasan Minimal) = Minimum Mastery Criterion; Classical completion target $\geq 75\%$ of students

Observational data were collected during each cycle using a participatory observation checklist recording four motor skill indicators: (a) understanding running commands; (b) understanding walking commands; (c) ball catching ability; (d) ball bouncing/dribbling ability. The researcher adopted a non-obtrusive participant observer role, recording observations from classroom and playground positions without interfering with the natural learning process.

Data validity was ensured through triangulation of three data sources: performance test scores, observational checklist records, and teacher interview data. Discrepancies between sources were resolved through follow-up observation. Data were analysed using descriptive qualitative comparative methods: comparing scores between pre-intervention, Cycle 1, and Cycle 2 to identify improvement patterns, and comparing observational checklist data across cycles to track individual motor skill trajectories.

Cycle 1 consisted of structured small ball game activities centred on command-based locomotor tasks. Each session began with a warm-up phase in which the teacher issued verbal running and walking commands (aba-aba lari and aba-aba jalan) accompanied by whistle and clapping cues to orient students' attention. The main activity phase involved throwing, catching, and bouncing exercises using rubber balls of uniform size, conducted in a group format with the teacher stationed at the front of the activity space. Sessions followed a fixed sequence: locomotor command response → individual ball catching → ball bouncing → simple relay. The teacher provided immediate verbal feedback and physical prompting for students who did not respond independently to commands.

Based on the Cycle 1 reflection, several modifications were implemented in Cycle 2 to address identified limitations. These included: (a) introduction of multi-coloured balls to increase visual salience and task variety; (b) incorporation of competitive relay formats to leverage social motivation; (c) strategic repositioning of the teacher to ensure equitable visual access for all students; and (d) expanded task repertoire including partner catching and sequential bouncing drills. The Cycle 2 format maintained the command-based structure of Cycle 1 while enriching the activity complexity and motivational context, consistent with the progressive overload principle of motor learning.

2.4 Data Analysis Technique

The collected data were analyzed using descriptive quantitative and qualitative techniques. Quantitative analysis was performed by calculating individual motor performance scores, class mean scores, and classical mastery percentages at three measurement points: baseline, Cycle 1, and Cycle 2. Student achievement was

evaluated based on the Minimum Mastery Criterion (KKM) of 7.0, while classical mastery was considered achieved when at least 75% of students met the criterion.

Qualitative data obtained from observations, documentation, and teacher interviews were analyzed descriptively to identify patterns of behavioral change, motor skill development, and student engagement across the intervention cycles. Comparative analysis was conducted between baseline, Cycle 1, and Cycle 2 findings to evaluate the effectiveness of the small ball game intervention and to inform reflective improvements implemented in subsequent cycles.

3. RESULTS AND DISCUSSION

3.1 Baseline Conditions (Pre-Intervention)

At baseline, observational data confirmed that Grade III SLB Negeri Kendal students with moderate ID exhibited the characteristic motor challenge profile of this population: limited responsiveness to verbal commands during group instruction, tendency to wander or engage in self-directed play during PE lessons, and inconsistent ball manipulation skills. When the teacher provided verbal commands, some students responded appropriately while others remained inattentive or imitated peer movements without independently processing the instruction. The use of whistles and clapping by the teacher partially improved attentiveness. Performance test results are presented in Table 2.

Table 2. Baseline Motor Skill Performance: Pre-Intervention Scores

No.	Student Code	Sex	Baseline Score	Mastery Status	Notes
1.	RN	F	6.0	Not Mastered	Understands commands; limited ball skills
2.	OP	F	6.0	Not Mastered	Understands commands; limited ball skills
3.	RON	M	7.0	Mastered	Good locomotor response to commands
4.	RZ	M	7.0	Mastered	Good locomotor response to commands
5.	UD	M	7.0	Mastered	Good locomotor response to commands
6.	WW	M	7.0	Mastered	Good locomotor response to commands
7.	FQ	M	6.0	Not Mastered	Partial command understanding only
8.	ML	M	6.0	Not Mastered	Partial command understanding only
Total			52	4/8 Mastered	Classical completion: 50%
Mean			6.50	Below KKM target KKM target: $\geq 7.0 / 75\%$	

F = Female; M = Male; KKM = Kriteria Ketuntasan Minimal

Based on Table 2, the pre-intervention assessment indicates that students' motor skill performance was generally below the expected competency threshold (KKM = 7.0). Only 4 out of 8 students (50%) achieved the mastery criteria, while the remaining students demonstrated limited proficiency in ball manipulation and inconsistent responsiveness to instructional cues. The overall mean score of 6.50 further confirms that the class had not yet reached the minimum expected level of motor competence.

Despite some students showing adequate locomotor responses and the ability to follow simple commands, a considerable proportion still required repeated prompting and demonstrated difficulties in maintaining attention during physical education activities. These findings highlight the necessity of a structured and engaging motor skill intervention to improve both attentional behavior and fundamental movement skills in students with moderate intellectual disability.

3.2 Post-Cycle 1 Results

After Cycle 1 implementation (small ball games with command-based locomotor activities), performance test scores improved for five of eight students, with the class mean rising from 6.5 to 7.0 and classical completion from 50% to 62.5% (5 of 8 students achieving ≥ 7.0). Student OP, who had scored 6.0 at baseline, achieved 7.0 post-Cycle 1, crossing the KKM threshold. RON improved from 7.0 to 7.5, and RZ improved from 7.0 to 8.0, indicating not only maintenance of baseline mastery but positive skill elaboration. Observational data from Cycle 1 revealed that: 62.5% of students (5/8) understood running commands (aba-aba lari); 75% (6/8) understood walking commands (aba-aba jalan); 37.5% (3/8) demonstrated ball catching ability; and 37.5% (3/8) demonstrated ball bouncing ability. The reflection phase identified that three students (RN, FQ, ML) remained below KKM, with observation noting persistent concentration difficulties, brief self-directed wandering during group instruction, and limited engagement with ball manipulation tasks. Full Cycle 1 scores are presented in Table 3.

Table 3. Motor Skill Performance After Cycle 1 (Cardboard Command-Based Small Ball Games)

Student	Sex	Baseline	Cycle 1 Score	Change	Mastery Status	Observation Notes
RN	F	6.0	6.5	+0.5	Not Mastered	Understands walking; catches ball
OP	F	6.0	7.0	+1.0	Mastered ✓	Understands walking; catches ball
RON	M	7.0	7.5	+0.5	Mastered ✓	Understands both commands; runs/walks

Student	Sex	Baseline	Cycle 1 Score	Change	Mastery Status	Observation Notes
RZ	M	7.0	8.0	+1.0	Mastered ✓	Full command + ball skills (catch & bounce)
UD	M	7.0	7.0	0	Mastered ✓	Understands both commands; runs/walks
WW	M	7.0	6.5	-0.5	Not Mastered	Understands running only; attention lapsed
FQ	M	6.0	6.5	+0.5	Not Mastered	Understands running; walks independently
ML	M	6.0	7.0	+1.0	Mastered ✓	Understands walking; bounces ball
Total/Mean		6.50	7.0	+0.5	5/8 = 62.5%	Below KKM target (75%)

WW score decrease from 7.0 to 6.5 due to attention lapse during test administration; not indicative of skill regression

Based on Table 3, Cycle 1 shows an improvement in students' motor skill performance following the implementation of small ball games with command-based locomotor activities. The class mean increased from 6.50 to 7.00, and classical mastery improved from 50% to 62.5% (5 of 8 students reaching the KKM \geq 7.0). OP and ML successfully crossed the mastery threshold after improving by +1.0 point, while RON and RZ demonstrated further enhancement of already adequate skills, with RZ achieving the highest score (8.0). RN and FQ showed limited improvement but remained below the target, whereas WW's slight score decrease was attributed to reduced attention during assessment rather than motor regression.

Observational data indicated improved responsiveness to locomotor commands, particularly walking and running instructions, although ball manipulation skills (catching and bouncing) were still limited in several students. Overall, Cycle 1 results suggest a positive initial effect of the intervention on both attention and fundamental motor coordination, although further improvement is required to reach the 75% mastery target.

3.3 Post-Cycle 2 Results

After Cycle 2 implementation (enriched competitive ball game activities), motor skill performance showed further and clinically meaningful improvement. The class mean rose from 7.0 to 7.43, and classical completion reached 87.5% (7 of 8 students), exceeding the 75% KKM target for the first time. Student RN, who had not reached KKM at baseline or post-Cycle 1 (6.0 \rightarrow 6.5 \rightarrow 7.0), achieved mastery. RON improved from 7.5 to 8.0, RZ from 8.0 to 8.0 (maintained), UD improved from 7.0 to 8.0, FQ improved from 6.5 to 7.5 (achieving mastery), and ML improved from 7.0 to 7.5. WW was the single student remaining below KKM (6.5), which observation attributed to consistent attentional difficulties and limited responsiveness to competitive task structures. Observational data from Cycle 2 confirmed comprehensive motor skill improvement: 100% (8/8) of students understood running commands; 87.5% (7/8) understood walking commands; 87.5% (7/8) demonstrated ball catching ability; and 50% (4/8) demonstrated ball bouncing ability. Full Cycle 2 data are presented in Table 4.

Table 4. Motor Skill Performance: Cross-Cycle Comparison

Student	Sex	Baseline	Cycle 1	Cycle 2	Total Gain	Final Status	Trajectory
RN	F	6.0	6.5	7.0	+1.0	Mastered ✓	Progressive improvement
OP	F	6.0	7.0	7.0	+1.0	Mastered ✓	KKM achieved Cycle 1, maintained
RON	M	7.0	7.5	8.0	+1.0	Mastered ✓	Consistent improvement both cycles
RZ	M	7.0	8.0	8.0	+1.0	Mastered ✓	High gain Cycle 1, plateau Cycle 2
UD	M	7.0	7.0	8.0	+1.0	Mastered ✓	Delayed improvement to Cycle 2
WW	M	7.0	6.5	6.5	-0.5	Not Mastered	Persistent attention difficulties
FQ	M	6.0	6.5	7.5	+1.5	Mastered ✓	Largest gain; competitive tasks helped
ML	M	6.0	7.0	7.5	+1.5	Mastered ✓	Strong response to Cycle 2 enrichment
Mean		6.50	7.00	7.43	+0.93	7/8 = 87.5%	KKM target (75%) exceeded ✓

KKM = Kriteria Ketuntasan Minimal (score \geq 7.0 individual; \geq 75% of class achieving KKM)

Based on Table 4, Cycle 2 results show a clear and consistent improvement in students' motor skill performance across cycles. The class mean increased from 7.00 to 7.43, and classical mastery reached 87.5% (7 of 8 students), exceeding the KKM target. Most students demonstrated continuous progress, particularly RN, FQ, and ML, while UD showed delayed but significant improvement in Cycle 2. RON and RZ maintained high performance levels, whereas WW remained below the mastery threshold due to persistent attentional difficulties.

These quantitative findings are further supported by observational data presented in Table 5, which illustrates the development of specific motor skill indicators across Cycle 1 and Cycle 2.

Table 5. Observational Motor Skill Indicators: Cross-Cycle Comparison (% Students Demonstrating Skill)

Motor Skill Indicator	Cycle 1 (%)	Cycle 2 (%)	Change
Understands running commands (aba-aba lari)	62.5% (5/8)	100.0% (8/8)	+37.5%
Understands walking commands (aba-aba jalan)	75.0% (6/8)	87.5% (7/8)	+12.5%
Can catch a small ball (menangkap bola)	37.5% (3/8)	87.5% (7/8)	+50.0%
Can bounce/dribble a small ball (memantulkan bola)	37.5% (3/8)	50.0% (4/8)	+12.5%

Based on Table 5, observational indicators confirm substantial improvement in motor skill acquisition. Understanding of running commands reached 100%, while walking commands increased to 87.5%. Ball catching ability showed the most notable gain, rising from 37.5% to 87.5%. Although improvement in ball bouncing skills was more limited (50%), overall results indicate enhanced coordination, responsiveness, and engagement in structured motor tasks following Cycle 2 intervention.

3.4 Overall Intervention Effectiveness and Alignment with International Evidence

The primary finding of this study that structured small ball game activities integrated into physical education produced meaningful, progressive improvements in motor skills across two CAR cycles, with classical completion rising from 50% to 87.5% is consistent with the broader evidence base for play-based physical activity as a motor skill intervention in children with intellectual disability. Meta-analytic reviews have demonstrated that structured physical activity programmes of 8–16 weeks duration produce significant improvements (effect sizes $d = 0.5–1.2$) in balance, coordination, and manipulative skills in children with ID. The present study, conducted over two discrete cycles with a four-week intersession interval, produced a mean score improvement of 0.93 points (from 6.5 to 7.43) and a 37.5 percentage point increase in class completion outcomes that align with the magnitude of effects reported in the international literature despite the substantially smaller sample size characteristic of action research designs.

3.5 Cross-National Contextual Implications

The findings of the present study are consistent with evidence reported across several developing and middle-income educational contexts where adapted physical education programs are implemented under limited-resource conditions. Previous studies have shown that students with intellectual disability often experience delays in fundamental movement skills, while structured and repetitive motor activities incorporating verbal instruction and social interaction contribute positively to motor development and functional movement performance. Similar patterns have been documented in special education settings where low-cost, easily implemented activities are prioritized to accommodate resource limitations and diverse student needs [28].

The small ball game intervention evaluated in this study shares several characteristics commonly associated with successful adapted physical activity programs, including repetitive practice opportunities, verbal command integration, active student engagement, and small-group participation [29], [30]. These features appear to facilitate the development of locomotor and object-control skills while simultaneously enhancing students' responsiveness to instructional cues [31]. The substantial improvement observed across the two intervention cycles therefore aligns with previous findings indicating that structured play-based activities can effectively support motor learning among children with intellectual disability.

Furthermore, growing international evidence emphasizes the importance of functional motor development within adapted physical education, particularly through activities that combine locomotor movements with object manipulation tasks. Ball-based activities have been shown to improve hand–eye coordination, movement control, and gross motor performance when implemented through progressive and systematically structured learning experiences. The improvements documented in running-command comprehension, ball-catching ability, and ball-bouncing performance in the present study are consistent with these broader trends.

3.6 Theoretical Advantages of Small Ball Games as Motor Intervention

The specific advantages of small ball games as a motor intervention modality for moderate ID students are worth elaborating. Ball activities engage the visual, proprioceptive, and vestibular sensory systems simultaneously a multi-sensory stimulation profile that is particularly valuable for students with ID, whose sensory integration deficits contribute to motor learning difficulties [32], [33]. The act of tracking a ball's trajectory activates visuomotor pathways; catching engages anticipatory motor programming and hand-eye coordination; bouncing and dribbling develop fine motor control of finger and wrist flexor muscles [34], [35]. Together, these activities address both gross motor (locomotion, locomotor command response) and fine motor (manipulation, coordination) domains within a single, ecologically coherent activity context a characteristic that makes ball games more efficient as an intervention than domain-specific drills that address only one motor system at a time [36].

Furthermore, ball games are intrinsically reinforcing in ways that align with the motivational profile of students with ID. The immediate, concrete, and visually salient feedback provided by ball interactions the ball either goes where intended or does not creates a natural error detection and correction loop that supports the

procedural learning systems relatively preserved in this population. This feedback immediacy contrasts favourably with the abstract, delayed feedback characteristic of traditional academic instruction, explaining in part why physical activity contexts often elicit better engagement from students with moderate ID than classroom-based tasks.

3.7 Verbal Command Processing and Language-Motor Integration

A distinctive feature of this study's intervention was its explicit incorporation of verbal command processing (aba-aba) as both an instructional medium and a motor skill assessment indicator. The improvement in command comprehension from Cycle 1 to Cycle 2 was marked for running commands (62.5% → 100%) and meaningful for walking commands (75% → 87.5%). This finding has important theoretical and practical significance.

Theoretically, the improvement in verbal command processing reflects the language-motor interface that is particularly important for students with moderate ID. Research has established that students with ID benefit from repeated, paired verbal-motor instruction in which verbal labels are consistently linked to specific physical actions across multiple exposures. The small ball game protocol, by consistently pairing verbal commands ('lari', 'jalan', 'tangkap') with concrete physical actions in a high-repetition, motivationally engaging context, functioned as an implicit language-motor training paradigm. This cross-domain benefit motor skill improvement accompanied by verbal comprehension improvement illustrates the holistic developmental value of well-designed physical education for students with ID [37]. Practically, command-based physical activity has direct functional relevance for daily living. The ability to respond appropriately to verbal commands for movement a skill that generalises to following teacher instructions in classroom settings, responding to caregiver directives, and navigating public environments safely has life-skill value that extends well beyond the PE context. This functional generalisation potential strengthens the case for command-based physical activities as a priority in SLB curricula for students with moderate ID.

3.8 Individual Variation in Response Trajectories

The cross-cycle data revealed meaningful individual variation in the trajectory and magnitude of motor skill improvement that warrants attention. Two students (FQ and ML) showed their most substantial gains in Cycle 2 (+1.5 points each), suggesting that the enriched competitive and multi-activity format introduced in Cycle 2 was particularly effective for these learners. In contrast, RZ showed large Cycle 1 gains (6.0 → 8.0 → 8.0) but plateaued in Cycle 2, suggesting potential ceiling effects within the task complexity level offered. UD showed a delayed improvement pattern (7.0 → 7.0 → 8.0), with gains emerging only after the more varied Cycle 2 format. WW remained below KKM throughout, with observational data consistently noting attention difficulties and limited engagement with group competitive activities.

These differential response patterns are consistent with the well-documented heterogeneity of moderate ID as a diagnostic category. Students classified within the same IQ band may differ substantially in their profiles of cognitive strengths and weaknesses, sensory processing, temperament, and social motivation all of which influence how they respond to specific instructional modalities [38], [39]. WW's non-response to both cycle formats, for example, may reflect attentional profiles that would benefit from a more structured, individual-attention intensive format (one-on-one instruction or very small groups of 2–3) rather than the small-group format employed here [40]. This interpretation is supported by research showing that instructional intensity defined partly by teacher-to-student ratio is a critical moderator of intervention effectiveness for students with more severe ID profiles.

3.9 Value of the CAR Methodology in Adapted Physical Education

The CAR design employed in this study produced a specific pedagogical dividend that merits recognition: the structured reflection between cycles enabled the identification of concrete, addressable factors that were limiting Cycle 1 effectiveness insufficient task variety, teacher positioning constraints, limited competitive motivation, and mono-modal ball equipment. The Cycle 2 modifications that addressed these factors (varied coloured balls, enriched task repertoire, competitive relay formats, strategic teacher repositioning) directly produced the improved outcomes evidenced in the Cycle 2 data. This demonstration of the Reflect → Revise → Implement → Evaluate loop that characterises CAR confirms its value as a research-practice integration methodology for adapted physical education contexts.

Importantly, the pedagogical refinements identified through CAR in this study are not idiosyncratic to this specific classroom context [41]. They reflect general principles of adapted PE practice that are documented in the international literature: task variability to accommodate heterogeneous learning profiles, competitive task structures to leverage social motivation, and optimised teacher positioning to ensure equitable instructional access. The CAR methodology thus served not only as a research design but as a professional learning process that enabled the teacher-researcher to translate general principles into context-specific effective practice a dual function with

particular relevance for Indonesian SLB practitioners who may have limited access to specialist adapted PE training.

3.10 Practical Implications

The findings of this study provide practical guidance for adapted physical education teachers working with students with moderate intellectual disability. Small ball games require minimal equipment, are easy to organize, and can be adapted to different levels of student ability. Schools with limited facilities can implement similar interventions using inexpensive materials while maintaining high levels of student engagement. Furthermore, integrating verbal commands with motor activities may contribute not only to motor development but also to receptive language skills and classroom behavioral regulation. From a theoretical perspective, the findings support contemporary motor learning theories emphasizing the interaction between sensory integration, repeated practice, and motivational engagement in skill acquisition. The results further reinforce the proposition that motor development among students with intellectual disability can be enhanced through structured play-based learning environments that simultaneously stimulate cognitive, linguistic, and motor processes.

3.11 Limitations and Future Research

Several methodological limitations should be acknowledged in interpreting these findings. First, the very small sample size ($n = 8$) a structural feature of CAR designs conducted in SLB Grade III classes severely limits the generalisability of results to other moderate ID populations, school types, or geographic contexts. Second, the absence of a control condition means that observed improvements cannot be attributed with certainty to the small ball game intervention; maturation, practice effects, and regression to the mean are alternative explanations that cannot be ruled out. Third, the assessment instrument, while appropriate for the Indonesian SLB context, has not been formally validated against internationally standardised motor assessment tools (e.g., Movement Assessment Battery for Children, Bruininks-Oseretsky Test of Motor Proficiency), limiting comparability with international findings. Fourth, the two-month study duration precludes assessment of whether observed motor skill gains were maintained over longer periods.

Future research should address these limitations through: (1) multi-school, geographically diverse samples enabling more robust generalisation; (2) randomised or quasi-experimental designs with control conditions; (3) concurrent administration of validated motor assessment instruments alongside the contextually adapted performance test; (4) longitudinal follow-up to assess retention of motor skill gains; (5) investigation of optimal dosage parameters (session frequency, duration, total programme weeks) for small ball game motor interventions in moderate ID populations; and (6) examination of whether concurrent cognitive or academic benefits accompany the motor improvements documented here, given evidence that physical activity can improve executive function in individuals with ID.

4. CONCLUSION

This Classroom Action Research study provides evidence that structured small ball game activities, systematically implemented over two iterative cycles with reflective refinement between cycles, effectively improve motor skills in students with moderate intellectual disability within an Indonesian special needs school context. The classical completion rate progressed from 50% at baseline to 62.5% after Cycle 1 and 87.5% after Cycle 2 the latter exceeding the 75% minimum mastery target accompanied by consistent improvements in all four observed motor skill indicators, particularly ball catching (37.5% → 87.5%) and running command comprehension (62.5% → 100%). The findings support the integration of small ball games as a foundational component of adapted physical education programmes for moderate ID students in Indonesian SLB settings, offering a low-cost, culturally accessible, and pedagogically effective strategy for addressing the motor deficits that significantly impair this population's independence and quality of life. The CAR framework, by enabling systematic reflection and targeted refinement between intervention cycles, proved to be a productive methodology for developing context-sensitive adapted PE practice.

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AUTHOR CONTRIBUTIONS

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CONFLICTS OF INTEREST

The authors declare no conflict of interest.

USE OF ARTIFICIAL INTELLIGENCE (AI)-ASSISTED TECHNOLOGY

Not applicable.

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