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(IJEPC)**www.ijepe.com**STRUCTURED PHYSICAL ACTIVITY MODULE FOR
CHILDREN WITH AUTISM: ENHANCING MOTOR, SOCIAL,
AND BEHAVIORAL DEVELOPMENT**Syuhadah Othman¹, Eshelvana Elve Irin², Aisyah Zainudin³, Mohamad Nizam Nazarudin^{4*}¹ Faculty of Education, Universiti Kebangsaan Malaysia, Bangi, Selangor, Malaysia
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DOI: 10.35631/IJEPC.1061022**Abstract:**

Physical fitness is a fundamental determinant of health and functional independence, particularly for individuals with special needs who often face barriers to physical activity. Aquatic environments offer unique therapeutic and educational advantages, yet structured aquatic interventions remain underexplored within Malaysian special education contexts. This study aimed to investigate the effectiveness of a structured aquatic program in enhancing muscle strength, balance, and coordination among students with special needs, and to assess the sustainability of these improvements over time. A quasi-experimental single-group pre-test–post-test design was employed involving four students (N = 4) from a Malaysian special education center. The 12-week aquatic program was based on the Halliwick Concept and Aquatic Sensory Integration Framework, with three evaluation phases: pre-test, post-test, and post-test 2 (follow-up). Performance was assessed through push and glide, floating, bubble jump, and flutter kick tests. Data were analysed descriptively and supported by observational records. Significant improvements were observed across all components, particularly in propulsion, balance, and endurance. Average gains ranged from 80% to 120%, with retention exceeding 80% during the follow-up phase. Participants also demonstrated increased confidence, motivation, and water adaptability. The structured aquatic program effectively enhanced physical fitness and sustained motor performance among students with special needs. The findings support

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the integration of aquatic-based interventions into Malaysia's inclusive education framework as a pedagogical and rehabilitative strategy promoting lifelong participation and wellbeing

Keywords:

Aquatic Therapy, Special Needs Education, Physical Fitness, Motor Learning, Inclusive Physical Education, Halliwick Concept

Introduction

Physical activity has long been recognized as a crucial determinant of children's holistic development, influencing not only their physiological fitness but also their cognitive, social, and emotional functioning. For children with Autism Spectrum Disorder (ASD), structured physical activity offers unique therapeutic value that transcends conventional medical and behavioral interventions. It provides sensory stimulation, promotes social connectedness, and encourages behavioral regulation core developmental domains typically impaired in autism (Bo et al., 2019; Chan et al., 2021). Globally, the rising prevalence of ASD has drawn increased scholarly and policy attention toward identifying effective, evidence-based interventions that integrate physical, social, and cognitive development within inclusive educational environments.

The global prevalence of ASD has grown significantly over the past two decades. The Centers for Disease Control and Prevention (CDC) estimates that one in every 36 children in the United States is diagnosed with ASD as of 2023, reflecting not only improved diagnostic awareness but also genuine increases in incidence (Zhao & Chen, 2018). This pattern mirrors trends across Asia, including Malaysia, where the number of diagnosed children and special education enrolments continues to rise (Kaur et al., 2015). Such figures underscore an urgent need for interventions that extend beyond traditional therapy, particularly those that can be realistically integrated within the educational system.

While many intervention strategies emphasize behavioral modification, speech-language therapy, and occupational training, these approaches often neglect the motor and physical dimensions of child development (Ferreira et al., 2019). Research consistently shows that motor impairments such as difficulties in coordination, postural control, and muscle strength are highly prevalent among children with ASD and significantly influence their learning capacity, social participation, and daily functioning (Bo et al., 2019; Monteiro et al., 2022). Consequently, limited attention to physical competence represents a missed opportunity to address the broader developmental needs of children within the autism spectrum.

Physical Activity as Developmental Intervention

Physical activity plays a multifaceted role in child development. Beyond improving physiological fitness, it also serves as a medium for social learning, emotional regulation, and behavioral adaptation (Sansi et al., 2021). Studies have demonstrated that structured, rhythmic, and engaging physical programs such as cooperative games or motor-based routines significantly enhance attention, cooperation, and affective stability among children with ASD (Iliadis & Apteslis, 2020; Teh et al., 2022). Such activities also activate neurobiological pathways associated with sensory integration and executive functioning, promoting behavioral balance and social readiness (Zhao & Chen, 2018).

In Malaysia, the potential of physical activity-based intervention for children with autism remains underexplored. Despite promising international evidence, special education curricula still prioritize academic or behavioral remediation approaches (Kaur et al., 2015; Rizal et al., 2019). Teachers often lack structured frameworks or empirically tested modules that can guide the implementation of physical activities tailored to ASD characteristics. As a result, existing practices are frequently ad hoc, inconsistent, and heavily dependent on individual teacher initiative rather than standardized guidelines (Ferreira et al., 2019).

Theoretical Underpinning

Several established psychological and educational theories support the integration of physical activity as an intervention for ASD. Bandura's Social Cognitive Theory (1977) posits that children learn behaviors through observation, imitation, and social reinforcement. Within group-based physical activity, ASD learners observe peers, model appropriate social behaviors, and receive reinforcement through shared success or enjoyment (Michalopoulou, 2023). This mechanism naturally enhances social and communication skills without relying on abstract verbal instruction. Complementing this is Skinner's Behavioral Theory (1965), which emphasizes reinforcement and conditioning. Structured physical activity environments inherently provide immediate reinforcement, praise, enjoyment, and mastery, which encourage the repetition of desirable behaviors and diminish maladaptive tendencies (Teh et al., 2022). Likewise, Motor Learning Theory emphasizes the importance of consistent, structured practice in developing neuromotor coordination (Sansi et al., 2021), while Developmental Neuropsychological Theory links sensory-motor stimulation to neuroplasticity and enhanced cognitive regulation (Bo et al., 2019). Together, these frameworks provide a multidimensional justification for using structured physical activity as a developmental bridge linking movement, cognition, social interaction, and emotional stability in ASD intervention design.

Problem Statement

Despite the strong theoretical and empirical basis for physical activity in autism intervention, its integration into special education systems in Malaysia remains limited. Research indicates that teachers lack training, structured modules, and institutional support to deliver movement-based programs effectively (Rizal et al., 2019). Moreover, the majority of local interventions rely on imported or generalized models that do not align with Malaysia's educational culture, resource availability, or student diversity (Kaur et al., 2015). Consequently, the implementation of physical activity for ASD learners is inconsistent and often short-term, resulting in minimal developmental gains. Furthermore, while international studies confirm improvements in motor and behavioral outcomes through structured exercise, evidence in the Malaysian context remains scarce and fragmented. Many available programs focus solely on cognitive or behavioral aspects, neglecting the integrated interplay between motor coordination, social communication, and behavior regulation (Monteiro et al., 2022; Chan et al., 2021). This narrow focus overlooks the holistic nature of child development, particularly in autism, where cross-domain reinforcement is critical.

Research Gap

Empirical literature demonstrates the benefits of physical activity for children with ASD (Chan et al., 2021; Sansi et al., 2021), yet few studies have operationalized these findings into structured, teacher-friendly modules adaptable to Malaysian classrooms. Existing models are typically experimental or clinical, lacking scalability and ecological validity for educational settings. Moreover, local studies seldom examine multi-domain outcomes specifically, how

physical activity simultaneously influences motor, social, and behavioral functions. The absence of integrated evaluation frameworks limits our understanding of how such interventions can enhance the overall quality of life for ASD children in Malaysian schools.

Hence, this study addresses these critical gaps by developing and testing a Physical Activity Module (PAM) specifically designed for Malaysian special education contexts. Grounded in social-cognitive, behavioral, and motor learning theories, the PAM emphasizes structured, repetitive, and enjoyable activities that target three developmental domains: motor coordination, social interaction, and adaptive behavior. Through an evidence-based and contextually responsive design, this study aims to provide empirical evidence of a proof of concept for scalable, school-based physical interventions that align with Malaysia's inclusive education agenda.

This study aims to evaluate the effectiveness of a structured Physical Activity Module (PAM) designed for children with Autism Spectrum Disorder (ASD) in improving their motor, social, and behavioral development within the Malaysian special education context. Specifically, the study seeks to:

1. RO1: Determine the effect of the Physical Activity Module on the motor coordination skills of children with autism.
2. RO2: Examine the impact of the module on the social interaction abilities of children with autism.
3. RO3: Assess the effect of the module on the reduction of maladaptive or non-adaptive behaviors among children with autism.
4. RO4: Evaluate teachers' perceptions of the module's practicality, adaptability, and overall effectiveness in supporting holistic development among ASD learners.

Corresponding to the objectives, the following research questions guide the study:

1. RQ1: Is there a significant difference in the motor skills of children with autism before and after participation in the Physical Activity Module?
2. RQ2: Is there a significant difference in the social interaction skills of children with autism before and after participation in the Physical Activity Module?
3. RQ3: Is there a significant difference in maladaptive behaviors among children with autism before and after participation in the Physical Activity Module?
4. RQ4: How do special education teachers perceive the effectiveness and applicability of the Physical Activity Module in enhancing motor, social, and behavioral outcomes?

Methodology

Research Design

This study adopted a quasi-experimental pre-test and post-test design without a control group, an approach suitable for applied educational research involving children with Autism Spectrum Disorder (ASD), where random assignment is often impractical or unethical (López-de-la-Fuente, García-Foncillas, & Gómez-Trullén, 2022). The design allowed for the examination of developmental changes in three target domains: motor coordination, social interaction, and behavioral adaptation, before and after participation in a structured Physical Activity Module (PAM).

This design aligns with previous intervention studies that evaluated behavioral and social outcomes through systematic physical activity participation among children with ASD (Bo, Lee, & Colle, 2019; Chan, Wong, & Chia, 2021). The pre–post framework was chosen to quantify immediate gains attributable to the intervention and to establish empirical foundations for larger-scale implementation.

Participants and Sampling

Participants were 12 children diagnosed with ASD, aged between 7 and 12 years, enrolled in a special education program. Participants were selected through purposive sampling based on the following inclusion criteria:

- (a) clinically confirmed ASD diagnosis by qualified professionals,
- (b) ability to comprehend simple verbal or visual instructions, and
- (c) adequate physical health to safely engage in structured movement activities.

Children with severe physical limitations or critical sensory impairments were excluded. Parental consent and teacher cooperation were obtained prior to participation. Small-sample, purposive sampling designs are widely used in autism intervention studies to ensure intensive observation and individualized monitoring (Chan et al., 2021; Sansi, Bassi, & Mendoça, 2021).

Intervention: The Physical Activity Module (PAM)

The intervention consisted of a structured Physical Activity Module designed specifically to promote development in three interconnected domains: motor, social, and behavioral. The module was grounded in Behavioral Theory (Skinner, 1965), Social Cognitive Theory (Bandura, 1977), and Motor Learning Theory, emphasizing repetition, modeling, and reinforcement as key learning mechanisms (Bo et al., 2019; Sansi et al., 2021).

The PAM was implemented over four consecutive weeks, with three sessions per week, each lasting approximately 45–60 minutes. Sessions were conducted by trained special education teachers under the researcher's supervision. The program incorporated the following sequential phases:

1. Motor Readiness: Simple stretching, balancing, and rhythmic locomotor activities.
2. Coordination Development: Jumping, running, object manipulation (e.g., throwing, catching).
3. Social Cooperation: Cooperative games, turn-taking, and paired activities fostering interaction.
4. Behavior Regulation: Relaxation exercises, routine closure, and reinforcement of adaptive behaviors.

Each activity was presented with visual prompts, verbal cues, and positive feedback, promoting imitation and engagement consistent with Bandura's (1977) principle of modeling. Activities were designed to be enjoyable, predictable, and adaptive to varying ability levels, as recommended by Iliadis and Apteslis (2020) and Teh, Rahim, and Ali (2022).

Instruments

Three observation-based instruments were used to evaluate pre- and post-intervention performance:

1. Motor Skills Assessment Scale – adapted from Bo et al. (2019) and Monteiro, Marques, and Mendes (2022), assessing balance, coordination, and postural control.

2. Social Interaction Checklist – adapted from Ayasrah et al. (2023), measuring cooperation, attention to peers, and participation in group play.
3. Adaptive Behavior Observation Form – adapted from Sansi et al. (2021) and Ferreira, et al. (2019), documenting reductions in maladaptive behaviors such as tantrums, repetitive actions, and aggression.

All scales employed a 5-point Likert rating (1 = poor, 5 = excellent). Internal consistency reliability was verified with Cronbach's α values between .83 and .91, and inter-rater reliability ($r = .89$) was established through a pilot evaluation by two independent observers. Teacher-reported instruments were preferred due to their ecological validity and daily proximity to the learners' behavior (Michalopoulou, 2023; Chan et al., 2021).

Procedure

The study was conducted in three stages:

1. Pre-Test Phase: Baseline data were collected by teachers using the standardized observation instruments prior to intervention.
2. Intervention Phase: The PAM was implemented according to the structured weekly plan. Teachers facilitated sessions under supervision to maintain fidelity.
3. Post-Test Phase: Teachers reassessed each participant using the same instruments immediately after the intervention period.

Data collection emphasized naturalistic observation to reflect authentic classroom behavior. Consistent implementation logs and weekly feedback ensured procedural consistency throughout the study (Ferreira et al., 2019; Teh et al., 2022).

Data Analysis

Quantitative analysis was performed using SPSS Version 29. Descriptive statistics (mean and standard deviation) summarized changes between pre- and post-test scores for each variable. Paired-sample t-tests were conducted to determine whether differences were statistically significant, with an alpha level of $p < .05$. Cohen's d effect sizes were calculated to estimate the magnitude of change (small = .20, medium = .50, large = .80). This analytical framework is consistent with established methods in prior ASD intervention studies evaluating physical activity outcomes (Bo et al., 2019; Monteiro et al., 2022; Sansi et al., 2021; Teh et al., 2022).

Validity and Reliability

The content validity of the PAM and observation instruments was confirmed through expert panel review involving specialists in adapted physical education and special needs pedagogy (Ferreira et al., 2019). Instrument reliability was ensured via pilot testing and inter-rater comparison, producing strong correlation values. Structured session plans, teacher logs, and observation checklists enhanced fidelity and reproducibility of implementation (Chan et al., 2021).

Ethical Considerations

The ethical principles of confidentiality, informed consent, and voluntary participation were adhered to. All parents were briefed on the research purpose, procedures, and potential benefits. The activities were non-invasive, safe, and designed to respect the sensory sensitivities of children with ASD. Teachers were instructed to monitor emotional readiness and apply

behavioral support when necessary, ensuring participant well-being throughout the study (Sansi et al., 2021; Michalopoulou, 2023).

Result and Findings

Descriptive Statistics

Descriptive analysis revealed consistent improvement across all domains of measurement. Mean scores for motor, social, and behavioral domains were higher in post-test results, suggesting substantial developmental gains after the four-week PAM intervention. Table 1 summarizes these descriptive statistics.

Table 1. Descriptive Statistics for Motor, Social, and Adaptive Behavior Scores (N = 12)

Variable	Minimum	Maximum	Pre-Test (SD)	Mean Post-Test (SD)	Mean Mean Difference
Motor Skills	2.10	4.70	2.81 (0.42)	4.12 (0.38)	+1.31
Social Skills	2.00	4.80	2.65 (0.48)	3.97 (0.52)	+1.32
Adaptive Behavior	1.90	4.50	2.43 (0.51)	3.82 (0.46)	+1.39

Note. Scores were rated on a 5-point Likert scale (1 = poor, 5 = excellent).

The descriptive outcomes illustrate a clear upward trajectory in all dimensions, with the largest improvement observed in motor coordination (+1.31) followed closely by social interaction (+1.32) and adaptive behavior (+1.39). Teachers' written reflections corroborated these numerical results, describing visible enhancements in coordination, participation, and emotional regulation during classroom activities.

Inferential Analysis

Paired-sample *t*-tests were used to determine whether observed improvements were statistically significant. The results, presented in Table 2, show significant increases ($p < .001$) across all three domains, with large effect sizes ($d > 1.3$) according to Cohen's (1988) interpretation.

Table 2. Paired-Sample t-Test Results for Pre-Test and Post-Test Scores on Developmental Domains (N = 12)

Domain	Pre-Test Mean (SD)	Post-Test Mean (SD)	Mean Difference	t	df	p	Cohen's <i>d</i>	Effect Size Interpretation
Motor Skills	2.81 (0.42)	4.12 (0.38)	+1.31	8.27	11	< .001	1.72	Large
Social Skills	2.65 (0.48)	3.97 (0.52)	+1.32	7.14	11	< .001	1.48	Large
Adaptive Behavior	2.43 (0.51)	3.82 (0.46)	+1.39	6.89	11	< .001	1.39	Large

Note. Significance level set at $p < .05$. Cohen's *d* benchmarks: small = 0.20, medium = 0.50, large = 0.80 (Cohen, 1988).

RO1 / RQ1: Effect of PAM on Motor Coordination

The first research objective sought to determine whether participation in the PAM significantly improved motor coordination among children with ASD. The results in Table 2 show a large, statistically significant increase ($t(11) = 8.27, p < .001, d = 1.72$). Participants demonstrated improved balance, coordination, and body control during locomotor and manipulative tasks, such as running, hopping, and ball-catching. This finding aligns with previous studies, which have reported that regular physical activity enhances neuromotor integration and movement precision among children with autism (Bo, Lee, & Colle, 2019; Monteiro, Marques, & Mendes, 2022). The improvement is consistent with Motor Learning Theory, which emphasizes the role of repetition and feedback in developing coordination and kinaesthetic awareness. Teachers observed improved posture and smoother movement sequences, reflecting better proprioceptive control and attentional focus during activities.

RO2 / RQ2: Effect of PAM on Social Interaction

The second objective was to examine whether the PAM improved **social interaction** among participants. Results revealed a statistically significant difference between pre- and post-test means ($t(11) = 7.14, p < .001, d = 1.48$). Table 3 illustrates the detailed subdimension performance derived from the Social Interaction Checklist.

Table 3. Social Interaction Subdomains: Pre- and Post-Test Mean Comparison

Subdomain	Pre-Test Mean (SD)	Post-Test Mean (SD)	Mean Difference	t- value	p- value
Peer Cooperation	2.58 (0.51)	3.89 (0.45)	+1.31	6.91	<.001
Communication Responsiveness	2.47 (0.49)	3.86 (0.57)	+1.39	6.62	<.001
Participation in Group Tasks	2.74 (0.46)	4.12 (0.50)	+1.38	7.33	<.001

The positive outcomes in peer cooperation and communication responsiveness demonstrate that group-based physical activities, such as cooperative games, team relays, and role-playing, effectively enhance social connectedness and peer awareness. These results align with Bandura's Social Cognitive Theory, which posits that observational learning and social reinforcement play central roles (Chan, Wong, & Chia, 2021; Iliadis & Apteslis, 2020). Teachers noted improved eye contact, shared laughter, and increased verbal interaction during sessions. Such behavior shifts were often accompanied by spontaneous helping gestures, indicating progress in both social cognition and emotional reciprocity.

RO3 / RQ3: Effect of PAM on Adaptive Behavior

The third objective focused on whether the PAM reduced maladaptive behaviors among participants. The analysis revealed a statistically significant improvement ($t(11) = 6.89, p < .001, d = 1.39$), characterized by notable decreases in negative behavioral indicators, including repetitive actions, aggression, and withdrawal.

Table 4. Adaptive Behavior Indicators: Change in Frequency and Rating

Behavioral Indicator	Pre-Test Mean (SD)	Post-Test Mean (SD)	Mean Difference	Direction of Change
Repetitive Movements	2.76 (0.41)	1.98 (0.37)	-0.78	Decreased
Tantrums / Aggression	2.58 (0.52)	1.87 (0.43)	-0.71	Decreased
Task Avoidance	2.48 (0.49)	1.75 (0.39)	-0.73	Decreased
Compliance / Cooperation	2.65 (0.47)	3.88 (0.50)	+1.23	Increased

Behavioral regulation improved markedly, reflecting the reinforcement mechanisms emphasized in Behavioral Theory (Ferreira, Lopes, & Santos, 2019; Teh, Rahim, & Ali, 2022). Structured physical routines provided consistent reinforcement, helping participants predict outcomes, reduce anxiety, and replace self-stimulatory behaviors with task-oriented actions. Teachers also reported fewer classroom disruptions and greater emotional calmness during transitions between tasks.

RO4 / RQ4: Teacher Perceptions of Module Practicality

Teacher feedback was analysed qualitatively to evaluate the practicality and sustainability of the PAM. Reflections were coded into three categories: (1) feasibility, (2) student engagement, and (3) developmental progress. Table 5 presents the thematic summary.

Table 5. Teacher Reflections on Implementation and Effectiveness of PAM

Theme	Description	Representative Comments
Feasibility	The module was easy to administer using available resources; suitable for daily school routines.	"The structure was clear, and the visual aids helped students follow each task."
Engagement	Students showed excitement and anticipation before sessions; participation increased over time.	"Students reminded us of 'exercise day'; they were eager to play together."
Developmental Progress	Noticeable improvements in movement coordination, cooperation, and emotional control.	"He can now wait for his turn and enjoys playing with peers."

Teacher perceptions reinforced quantitative findings, highlighting the PAM's practicality and adaptability for continuous use in special education classrooms. Consistent with Chan et al. (2021) and Michalopoulou (2023), educator-led interventions were essential in maintaining structure, providing feedback, and ensuring engagement. The results collectively affirm the effectiveness of the Physical Activity Module in enhancing motor, social, and behavioral domains among children with ASD. The large effect sizes across variables confirm the substantial developmental impact of structured physical movement programs.

Improvements in motor coordination align with prior evidence linking rhythmic exercise to neuromotor gains (Bo et al., 2019; Monteiro et al., 2022). Enhanced social interaction supports the observational learning framework (Chan et al., 2021; Iliadis & Apteslis, 2020), while reductions in maladaptive behaviors correspond to reinforcement-based behavioral conditioning (Ferreira et al., 2019; Teh et al., 2022). The triangulation of quantitative results and teacher observations validates the PAM as an effective, sustainable, and contextually adaptable intervention within inclusive education settings.

Discussion

The present study evaluated the effectiveness of a structured **Physical Activity Module (PAM)** in enhancing the motor coordination, social interaction, and behavioral regulation of children with Autism Spectrum Disorder (ASD). Findings demonstrated significant improvements across all three domains, with large effect sizes indicating that the intervention produced meaningful developmental changes. These results confirm and extend existing evidence that structured physical activity can act as a powerful multidimensional tool for supporting the holistic growth of children with autism (Chan et al., 2021; Monteiro et al., 2022).

Integration of Findings with Theories

The observed enhancement in motor coordination aligns with Motor Learning Theory, which emphasizes repetition, feedback, and task-specific practice as mechanisms for refining movement efficiency and neuromuscular control (Bo et al., 2019). During the four-week intervention, participants engaged in repetitive yet progressively challenging activities that required balance, manipulation, and spatial awareness. The significant gains in coordination align with findings from previous research, which have shown that consistent exposure to motor-based activities strengthens sensory integration and proprioceptive feedback in children with ASD (Monteiro et al., 2022; Sansi et al., 2021).

Improvements in social interaction can be explained through Bandura's Social Cognitive Theory, which highlights observational learning and social reinforcement as core drivers of behavioral acquisition. The group-oriented activities within the PAM, such as paired exercises and cooperative games, allowed participants to observe peers, model behaviors, and receive immediate reinforcement through praise and successful task completion. This process fostered increased participation, improved eye contact, and enhanced responsiveness to communication. These findings are consistent with those of Chan et al. (2021) and Iliadis and Apteslis (2020), who reported that structured and cooperative physical tasks promote peer imitation, empathy, and social inclusion in children with developmental challenges.

The reduction in maladaptive behaviors further supports Behavioral Theory, which posits that reinforcement and routine predictability strengthen desirable behaviors while minimizing disruptive or repetitive responses. Through consistent session structures, visual prompts, and positive feedback, participants developed behavioral self-regulation and reduced instances of aggression, self-stimulation, and task avoidance. Ferreira, Lopes, and Santos (2019) similarly observed that adaptive physical education programs, which leverage rewards and structure, yield marked decreases in maladaptive behaviors. Teh, Rahim, and Ali (2022) also found that regular movement-based sessions contributed to improved emotional control and classroom compliance among Malaysian children with special needs.

Practical and Educational Implications

From a practical perspective, the PAM's structure, comprising clear instructions, visual aids, and flexible intensity, proved feasible for use in typical special education classrooms. Teachers reported that the module's organization enabled smoother classroom management and increased student engagement. This finding supports earlier recommendations that educator-led physical activity interventions should be simple, visually guided, and easily adaptable (Michalopoulou, 2023). Importantly, the study demonstrates that effective interventions for ASD do not need to be resource-intensive; rather, success depends on consistent structure, teacher facilitation, and reinforcement-based delivery.

For Malaysia's inclusive education framework, these results have direct policy relevance. The consistent developmental benefits across motor, social, and behavioral domains indicate that physical activity should be systematically integrated into individualized education plans (IEPs) for children with ASD. As noted by Kaur, Ibrahim, and Ahmad (2015) and Rizal, Shamsuddin, and Aziz (2019), one major challenge in Malaysia's special education system lies in the lack of structured and contextually appropriate modules. The PAM addresses this gap by offering an empirically validated, teacher-friendly model adaptable to local contexts and varying levels of student ability.

Limitations and Future Directions

While the findings are promising, the study's small sample size limits the generalizability of the results. Future research should replicate the intervention with larger, more diverse cohorts and include longitudinal follow-up to assess the persistence of behavioral and social gains. Expanding the module duration and incorporating parent-assisted sessions could further enhance the generalization of learned behaviors beyond the classroom. Additionally, mixed-method approaches incorporating physiological or observational metrics could deepen understanding of the neurobehavioral mechanisms underlying change.

Conclusion and Recommendations

This study provides strong empirical evidence that a structured Physical Activity Module (PAM) can effectively enhance the motor coordination, social interaction, and behavioral regulation of children with Autism Spectrum Disorder (ASD). Across all three domains, significant improvements were observed, with large effect sizes confirming the magnitude of developmental change. These outcomes validate the multidimensional benefits of structured physical activity, supporting previous research emphasizing movement-based interventions as vital components in autism education and rehabilitation (Bo et al., 2019; Chan et al., 2021; Monteiro et al., 2022).

The results affirm the theoretical integration of Motor Learning Theory, Social Cognitive Theory, and Behavioral Theory within special needs pedagogy. The PAM's design, emphasizing repetition, modeling, and reinforcement, proved effective in stimulating sensorimotor function, encouraging social participation, and reducing maladaptive behaviors (Sansi et al., 2021; Ferreira et al., 2019; Teh et al., 2022). Through a structured yet playful approach, the module bridged physical and psychosocial domains, demonstrating that physical activity is not merely a supplement but an essential developmental pathway for children with ASD.

From a practical standpoint, the PAM offers a teacher-friendly, contextually adaptable model suitable for use within Malaysian special education settings. The clear structure, visual aids, and flexible activity levels enabled effective classroom integration without requiring specialized facilities or external therapists. This directly addresses local challenges highlighted by Kaur, Ibrahim, and Ahmad (2015) and Rizal, Shamsuddin, and Aziz (2019), who identified the lack of standardized, inclusive activity modules as a persistent limitation in Malaysian special education programs.

Recommendations:

1. **Curricular Integration:** The Ministry of Education should formally incorporate structured physical activity modules like PAM into the Special Education Curriculum Framework, ensuring alignment with Individualized Education Plans (IEPs) for children with ASD.
2. **Teacher Training:** Regular professional development workshops should be provided to special education teachers to enhance their competence in delivering movement-based learning activities grounded in social-cognitive and behavioral principles.
3. **Parent Involvement:** Future programs should include home-based extensions of the PAM to reinforce continuity between school and family environments, supporting sustained behavioral regulation.
4. **Longitudinal Research:** Future studies should expand the sample size, include a control group, and measure long-term retention of skills to further validate the module's effectiveness and scalability.

Overall, the findings highlight that structured physical activity is a low-cost, high-impact approach to promoting holistic development among children with autism. The PAM demonstrates potential as a model for inclusive practice that unites movement, learning, and social growth contributing meaningfully to Malaysia's aspiration for equitable and effective special education.

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