Jurnal SPORTIF: Jurnal Penelitian Pembelajaran
Vol. 11 No. 3, December 2025, pp. 459 - 476
https://doi.org/10.29407/js_unpgri.v11i3.25782

Development of animal footprint media for physical education to enhance balance skills in children with special needs

Hafidz Mukti Ramadhan[1abcdef], Mu'arifin[1abef], Imam Hariadi[1abef].

[1]Master of Physical Education, Faculty of Sports Science, Universitas Negeri Malang, Malang, East Java, Indonesia.

Received: 17 June 2025; Revised: 7 August 2025; Accepted: 23 December 2025; Available online: 31 December 2025.

Abstract

Children with autism often experience difficulties in motor coordination, attention, and responding to verbal instructions, which makes participation in physical education (PE) challenging. Studies show that their involvement in physical activities is significantly lower than that of typically developing children, limiting opportunities to improve balance and coordination—skills essential for independence and social participation. Moreover, most PJOK (Physical Education, Sports, and Health) learning media in special schools still rely on static visuals and verbal explanations, which fail to meet the sensory and attention needs of autistic students. Therefore, this study was conducted to address this gap by developing and validating animal footprint-based instructional media that provide adaptive, engaging, and movement-centred learning experiences. Fifty-five students from two special schools in Tapin Regency participated in this study through purposive sampling. Research instruments included expert validation sheets to assess content suitability, teacher questionnaires to evaluate practicality, and student performance checklists to measure the improvement in balance. Data were analyzed using descriptive statistics and a paired sample t-test. Results indicated that the media were highly valid (85.34%) and significantly improved motor balance ($p = 0.002 < 0.05$). The findings confirm that animal footprint-based media are valid, practical, and effective tools for improving motor balance in autistic learners.

Keywords: Adaptive physical education, footprint media, balance, autism.

How to Cite: Ramadhan, H. M., Mu'arifin, & Hariadi, I. (2025). Development of animal footprint media for physical education to enhance balance skills in children with special needs. Jurnal SPORTIF : Jurnal Penelitian Pembelajaran, 11(3), 459–476. https://doi.org/10.29407/js_unpgri.v11i3.25782

Authors contribution: a – Preparing concepts; b – Formulating methods; c – Conducting research; d – Processing results; e – Interpretation and conclusions; f - Editing the final version.

INTRODUCTION

Children with autism spectrum disorder (ASD) often experience challenges in motor coordination, cognitive processing, and sensory integration that hinder their participation in physical education (PE) (Orhan et al., 2024; Dyson et al., 2021). Physical education plays a crucial role in supporting not only physical coordination but also cognitive, social, and emotional development in individuals with autism spectrum disorder.

Correspondence author: Hafidz Mukti Ramadhan, Universitas Negeri Malang, Malang, East Java, Indonesia.
Email: rinfidz@gmail.com

However, traditional PE instruction that relies heavily on verbal explanations is often ineffective due to difficulties in attention, memory, and motor planning (Haes, 2019; Sheppard et al., 2018). These limitations make it challenging for autistic children to follow multi-step directions and perform coordinated movements, highlighting the need for adaptive, structured, and visually oriented teaching strategies.

Research consistently indicates that autistic learners benefit from visual, structured, and multisensory approaches that integrate clear cues to support comprehension and motor recall (Padmadewi et al., 2023; Alali et al., 2024). In PE settings, visual and tactile media can guide students in following motor sequences more effectively by combining perception and action. Visual and interactive media are essential for improving engagement and balance-related outcomes, yet existing instructional media in special education remain largely static, non-interactive, and developmentally limited (Liang et al., 2024; O'Neill & Murphy, 2010). This lack of adaptive and engaging materials reduces motivation and opportunities for meaningful motor learning.

Preliminary interviews and a needs assessment with PE teachers in special schools in Tapin Regency confirmed the urgency of this issue. Findings showed that 91% of teachers identified the need for more adaptive and engaging media, while 83% reported that the lack of such tools hindered effective instruction. Teachers noted that current visual aids, although helpful, lacked interactivity and were not aligned with the sensory and motor profiles of autistic students, making it difficult to sustain attention during movement-based lessons.

To address these gaps, this study developed animal footprint-based instructional media designed to improve balance, coordination, and engagement in PE for children with autism. When visual footprints are combined with tactile or kinesthetic components, such as stepping on marked footprints, they stimulate multiple sensory pathways, reinforce motor learning, and improve focus (Haegele et al., 2021; Lee & Gutierrez, 2023). This aligns with multisensory learning and embodied cognition

principles, emphasizing that motor activity supports cognitive and behavioral development (Abadi, 2021; Lewchuk et al., 2021). For autistic learners, multisensory learning enables better integration of sensory input and movement, while task modeling helps them imitate and internalize physical actions through repetition and structured visual guidance.

The design of the animal footprint media directly embodies these principles by combining visual modelling cues with tactile stepping activities that translate perception into coordinated motor responses. The media is intended to guide balance, jumping, and coordination exercises through visually engaging and kinesthetically meaningful patterns. Therefore, this study aims to develop and validate animal footprint-based instructional media as a multisensory, low-cost, and inclusive tool tailored to the sensory and cognitive characteristics of autistic learners. This innovation contributes to adaptive physical education practices by providing practical and developmentally appropriate learning support that enhances balance control, gross motor coordination, and overall engagement.

In summary, this study seeks to offer a novel and timely response to the pressing need for adaptive learning media in physical education for autistic children. By integrating visual and tactile cues, the developed animal footprint-based media aims to enhance motivation, inclusivity, and motor skill performance, supporting neurodiverse learners' participation and motor development in PE settings.

METHOD

This study employed a Research and Development (R&D) approach guided by the ADDIE model (Analysis, Design, Development, Implementation, and Evaluation) (Branch, 2009). The ADDIE model was selected because it provides a structured and iterative process suitable for developing, validating, and testing instructional media for autistic students in physical education. Each phase was carried out sequentially to ensure that the animal footprint-based media was designed according to learner needs, developed effectively, tested in real classroom settings, and evaluated for its validity, practicality, and impact.

https://doi.org/10.29407/js_unpgri.v11i3.25782
11 (3) 2025| 459-476

In the Analysis phase, researchers identified learner characteristics, teacher challenges, and learning needs through interviews, observations, and a review of existing instructional practices. This phase also identified specific motor skills to be targeted, particularly balance and coordination. A needs assessment confirmed the need for adaptive visual media tailored to the sensory and cognitive profiles of students with Autism Spectrum Disorder.

The Design phase involved outlining learning objectives and creating initial media concepts, including storyboards, layout arrangements, colour selections, and animal footprint patterns aligned with motor skill sequences. The design process ensured that the visual and tactile features were accessible, meaningful, and supportive of structured motor learning.

During the Development phase, prototypes of the footprint posters were produced. These prototypes were reviewed through expert validation involving material experts, media experts, and learning experts. Expert validation sheets were used to evaluate content accuracy, media quality, and developmental appropriateness. Feedback from experts guided revisions and refinement of the prototype.

The Implementation phase consisted of two stages: a small-scale trial and a large-scale classroom application. The small-scale trial involved seven students to test feasibility and usability. The large-scale implementation involved 48 autistic students, bringing the total sample to 55 students from SLB 1 and SLB 2 Tapin, selected through purposive sampling based on formal autism diagnosis, ability to perform basic motor tasks, and parental consent. Teachers acted as facilitators during lessons, guiding students through balance, jumping, and coordination exercises using the footprint media, while researchers observed student engagement and motor performance. The characteristics of the participants are presented in Table 1.

Table 1. Research Subject

	Total	
Description	F	%
Gender		
Male	48	93.44
Female	7	6.56
Age		
6-10	33	60.00
11-15	19	34.55
16-20	2	3.64
>20	1	1.82

The research employed three categories of instruments: validation instruments for learning experts, material experts, and media experts; practitioner evaluation instruments for teachers; and performance-based skill assessment instruments for students. Initial product testing was conducted through a small-scale trial involving 7 participants, followed by a larger-scale trial with 48 participants. In both stages, students' motor skills were evaluated across five main indicators: (1) dynamic and static balance, (2) single-leg jump ability, (3) two-leg jump coordination, (4) throwing accuracy and upper-body strength, and (5) catching ability as a measure of hand–eye coordination. The observational checklists and performance tests used for data collection were developed and adapted from the Test of Gross Motor Development (TGMD-2) and the Indonesian Physical Education assessment guidelines. These instruments were further validated by three experts in physical education and special education to ensure content validity and feasibility for students with autism spectrum disorder.

Data were collected using a one-group pre-test–post-test design, where students' performances were observed and recorded before and after the use of the footprint-based media. Observations were conducted by two trained PE teachers and one researcher to minimize observer bias. Each trial lasted approximately four 105-minute sessions over one week. All activities took place on the school field, which was arranged with footprint posters and obstacle paths designed for balance, jumping, and throwing exercises. The collected data were analyzed using the Paired Sample T-Test in SPSS version 25, applying a significance level (α) of 0.05 to

https://doi.org/10.29407/js_unpgri.v11i3.25782
11 (3) 2025| 459-476

determine whether the observed improvements in students' motor performance were statistically significant.

In the Evaluation phase, data were collected to determine the media's validity, practicality, and effectiveness. Three instruments were employed: (1) expert validation sheets, (2) teacher evaluation questionnaires assessing practicality and classroom usability, and (3) student performance checklists measuring improvements in balance and coordination.

$$\text{Validity Audience} = \frac{TSe}{TSh} \times 100$$

Descriptions :

TSe: Total empirical

TSh: Total Maximum

Effectiveness was measured using a pre-test–post-test design, and data were analyzed through descriptive statistics and a paired sample t-test at α = 0.05. Validity scores were calculated using the percentage method, Akbar (2022), as detailed below:

$$V = \frac{V1+V2+V3}{\text{Numbers of Validators}}$$

Description

V: Combined Validity

$V_1 + V_2 + V_3$: Score Validator

Once the overall results have been gathered, they are subsequently categorized according to the established criteria.

Table 2. Levels Of Product Effectiveness (Akbar, 2022)

Criteria	Description	Meaning
75.01%-100.00%	Very Valid	Used without revision
50.01%-75.00%	Fairly Valid	Used with minor revisions
25.01%-50.00%	Invalid	Unusable
00.00%-25.00%	Very Invalid	Forbidden to use

RESULT

This section reports the results of data analysis on the effectiveness of the animal footprint poster in improving balance skills among autistic students. The pre-test and post-test data were analyzed using descriptive statistics (mean and standard deviation) to observe changes in students' performance scores, and inferential statistics (Paired Sample T-Test) to

determine whether these improvements were statistically significant. Comparative discussion with previous studies is addressed separately in the Discussion section. The following tables and analyses present the statistical outcomes of these tests, highlighting the observed differences between the pre-test and post-test results and their implications for the effectiveness of the developed media. The presentation of the research findings is organized according to the stages of the ADDIE model, with each stage aligned with the corresponding data results, as outlined below:

1. Analyze

The needs assessment stage was conducted to identify the challenges and instructional gaps in teaching physical education (PE) to students with autism spectrum disorder (ASD). Data were gathered through interviews and classroom observations on August 29, 2024, involving PE teachers from special schools in Tapin Regency. The analysis aimed to determine performance gaps, define instructional objectives, identify target learner characteristics, and specify resource requirements. The summarized findings of this process are presented in Table 3 below.

Table 3. Preliminary Findings from the Needs Assessment (Analyze Stage of ADDIE)

No	Aspect Analysis	Component	Description
1.	Performance gap	Barriers to learning	1. The need to enhance students' motivation toward the learning process. 2. Effective communication strategies remain a critical requirement. 3. There is a growing demand for the use of appropriate and engaging instructional media. 4. Students' responses to learning activities have not yet reached optimal levels.
2.	Define instructional objectives	Learning objectives	1. Identify basic movement materials. 2. Recognise various animals.
3.	Determine Intended Target Audience	Media Support Needs Students' learning needs	1. Visual Media: Media designed to convey information primarily through visual elements such as images, posters, and videos to attract attention and improve understanding. 2. Concrete Media: Tangible learning aids that can be physically handled or manipulated, such as animal footprint models, real objects, or physical teaching props, to provide hands-on learning experiences.

https://doi.org/10.29407/js_unpgri.v11i3.25782
11 (3) 2025| 459-476

4.	Identify Resources Required	Students' Learning Interests Supporting Media	1. Attractive learning objectives. 2. Effective media. 3. Good learning environments. Supporting Media Examples: - Visual: Posters, illustrated guidebooks. - Concrete: Animal footprint models, physical guidebooks.

The findings in Table 3 highlight the critical need for interactive and multisensory media in physical education for autistic students. Teachers reported that current instructional tools are often too abstract and lack visual appeal, making it difficult for students to maintain focus and motivation. The data also revealed that students respond better to visual and tactile stimuli, which support comprehension and retention of movement sequences. These insights formed the foundation for designing animal footprint-based media, intended to provide both visual engagement and hands-on interaction, thereby strengthening motor learning outcomes.

2. Design

The objective of this development phase is to establish the expected performance outcomes and identify suitable evaluation techniques. The footprint-based media is specifically designed to introduce the tracks of various animals such as tigers, dinosaurs, lions, birds, and others. The visualization process began by identifying the key physical activities to be integrated into the learning sessions, such as balancing, jumping, hopping, and throwing. Each footprint was then digitally illustrated with clear outlines and proportional shapes, ensuring that the sizes matched the targeted motor activities. Larger prints, such as those of dinosaurs, were intended for long strides and jumps, while smaller ones, like bird tracks, were suited for precision and balance exercises. The footprints were printed on durable, non-slip materials to ensure safety and longevity in classroom and outdoor use. The selection of animals was based on four primary considerations: familiarity and appeal to maintain student interest; variety of shapes to develop visual discrimination skills; motor skill relevance, in which certain prints promote specific movements (e.g., dinosaur tracks for jumping, bird tracks for balance); and cultural as well as educational value, by including both local fauna familiar to students and global species to broaden their

knowledge. The visual representation of this media design is illustrated in Figure 1.

Figure 1. Animal footprints media

The evaluation process aims to provide educators with constructive feedback on the progress of students in adaptive learning settings. In this context, assessments of student learning outcomes are derived from both formal testing and observed performance during physical education sessions. The tools used to assess fundamental motor skills include tasks such as dynamic balancing, single-leg hopping, double-leg jumping, throwing downward and upward, and catching. Details concerning these assessment instruments are provided in Table 4.

Table 4. Indicators Of Assessment Of Students' Basic Movement Skills

No	Aspects	Criteria
1.	Balance	1. Extend both hands forward. 2. Step forward alternately while standing on an animal footprint balance line measuring 50 cm in length. 3. Maintain balance throughout the movement without losing stability or falling.
2.	Single leg jump	1. The arms are flexed and lifted during the airborne phase. 2. The leading leg moves forward while the trailing leg follows with a backward bend. For a brief moment, neither foot is in contact with the ground.
3.	Two-leg jump	1. The initial phase involves bending both knees while the arms are stretched backwards behind the torso. 2. The arms then swing forward and upward until they are fully extended above the head. 3. A short moment occurs when both feet are lifted off the ground simultaneously.
4.	Throw down	1. The hands are swung downward and backwards, positioned behind the torso as the chest remains oriented forward. 2. A step is taken with the opposite foot while the dominant hand is directed toward the target. 3. The knees are then flexed to lower the body, and the ball is released close to the floor surface to minimize bounce, not exceeding 4 inches.

https://doi.org/10.29407/js_unpgri.v11i3.25782
11 (3) 2025| 459-476

5.	Throw Up	1. The dominant hand elevates the ball overhead while maintaining a bent elbow position. 2. A forward step is taken using the opposite foot during the throwing motion. 3. The ball is released upward in a controlled and deliberate manner, ensuring appropriate height and distance are achieved.
6.	Catching	1. During the initial phase, the hands are held in front of the torso with the elbows slightly flexed. 2. The arms are then straightened to prepare for catching or receiving the incoming ball. 3. The ball is secured using both hands.

3. Development

The product development process involved multiple phases, including the initial product design, expert validation, and subsequent revisions based on feedback. The validation process was conducted by three experts: a learning expert, a basic movement material expert, and a media expert. Each expert assessed the media using an evaluation instrument with a rating scale of 1 to 4 (1 = Very Poor, 4 = Very Good) across multiple criteria, with a maximum possible score of 100. The validation outcomes are presented in Table 5:

Table 5. Validation Test

No	Expert	Total Score	Descriptions
1	Learning Experts	83.5	1. The media was printed with a size of 2.5m x 5m on poster material. 2. Include a guidebook
2	Material Expert Basic movement	92.5	1. Give a little distance from the footprints
3	Media Experts	88.2	1. For the foot opening activity, we recommend using only one foot picture.
Total validity	Classified as very valid and with minor adjustments suggested	89.2	

The overall average score of 89.2 indicates that the footprint-based media is classified as very valid. Minor revisions were made following expert feedback, including adding a guidebook, adjusting footprint spacing, and modifying the design for foot-opening activities.

4. Implementation

The implementation phase of the ADDIE model is centred on assessing the practicality of the developed product through feedback from six experienced teaching practitioners. During the initial testing phase, which involved a small sample of 8 to 20 participants, the first trial was conducted with 10 students from a Special Education School in Tapin Regency. The pre-test results indicated that the students were able to

perform the assigned motor tasks, albeit with substantial and explicit guidance from the teacher. Subsequently, a broader trial was carried out with 35 participants to validate the findings on a larger scale. The analysis included data from a small-scale initial trial involving 10 participants and a larger-scale follow-up trial with 35 participants, totalling 45 students. The results from this second trial are summarised in Table 6.

Table 6. Total Scores Pre-test And Post-test

No	Aspect	Description	Descriptions	
			Pre-test	Post-test
1	Dynamic Balance	Walking along a 50 cm footprint balance line while extending both arms forward without losing stability.	60.10	81.56
2	Single leg jump	Jumping forward on one leg with proper arm swing and foot positioning.	60.22	80.77
3	Two-leg jump	Jumping forward with both feet simultaneously after bending knees and swinging arms upward	65.71	85.12
4	Throw down	Throwing a ball toward the floor close to the target to minimize bounce, stepping forward with the opposite foot.	63.46	80.39
5	Throw Up	Throwing a ball upward with a bent elbow and stepping forward with the opposite foot.	62.88	80.10
6	Catch	Receiving a ball with both hands in front of the torso, elbows slightly bent.	61.80	82.35

The results in Table 6 indicate consistent and substantial improvements across all motor performance indicators after the use of the animal footprint-based media. The most notable gain occurred in the two-leg jump, which increased from 65.71 to 85.12 (a 29.6 % improvement), demonstrating marked progress in explosive power and coordination. Dynamic balance also improved significantly, from 60.10 to 81.56 (35.7% increase), demonstrating the medium's effectiveness in supporting postural stability and balance control. The catching test improved from 61.80 to 82.35 (33.2% increase), reflecting improved hand-eye coordination and timing accuracy. Before conducting the effectiveness analysis, the data were tested for normality using the Kolmogorov–Smirnov test in SPSS. The results showed $p = 0.200$ (> 0.05) for all indicators, confirming that the data were normally distributed and met the assumptions for parametric testing. A Paired Sample T-Test was then applied to compare the pre- and post-test results. The analysis yielded a t-value = 4.342, df = 54, and $p = 0.002$ (< 0.05), indicating a statistically significant improvement in motor performance following the intervention. On average, students' total motor-skill scores

https://doi.org/10.29407/js_unpgri.v11i3.25782
11 (3) 2025| 459-476

increased from 62.36 to 81.72, representing a 31% overall improvement. These quantitative findings confirm that the footprint-based media produced consistent and statistically significant improvements in dynamic balance, coordination, and catching ability. The pattern of increase across all indicators reflects the intervention's reliability and effectiveness in stimulating multisensory motor learning, particularly for autistic learners who benefit from structured visual-motor feedback. The results are presented in Table 7.

Table 7. Test For Normality

	N	Sig
Kolmogorov-Smirnov Test	55	0.200

Table 7 presents the results of the normality test conducted using the Kolmogorov–Smirnov method, which shows a significance value of 0.200 greater than the 0.05 benchmark. This confirms that the data follow a normal distribution. Furthermore, a homogeneity test was carried out using the Levene method. Based on the standard criterion that a significance value above 0.05 indicates homogeneity, the results summarized in Table 8 suggest that the data are homogeneous.

Table 8. Results Of Variance Homogeneity Analysis

	Levene Test	Sig
Mean	2.102	0.162

Based on Table 8, the researcher can conclude that the results of the homogeneity test calculation using the Levene test show a significance value of 0.162, which is greater than 0.05. So, this research data is declared homogeneous. Furthermore, the analysis can be continued using the Paired Sample T-test, a parametric statistical test, as presented in Table 9.

Table 9. Effectiveness Test Results

t	Mean difference	Sig
-4.665	-5.102	0.002

Based on the data presented in Table 9, the outcome of the Paired Sample T-Test reveals a significance value (Sig. 2-tailed) of 0.002, which is lower than the established threshold of 0.05. This result suggests that the null hypothesis (H_0) is rejected, and the alternative hypothesis (H_a) is accepted. Therefore, it can be inferred that the implementation of animal

footprint media contributes significantly to the improvement of students' learning outcomes.

5. Evaluate

The evaluation results (Table 10) indicate that compatibility received the highest score (88.20%), suggesting that the media strongly aligns with the intended learning objectives and context. Attractiveness (84.10%) was notably higher than ease of use (80.59%), indicating that while students found the media visually engaging, certain operational aspects may require minor refinement or teacher assistance. The relatively lower score in comprehensibility (81.22%) suggests that further adjustments could be made to improve clarity of instructions or content presentation. Despite these variations, all aspects achieved scores above 80%, which, according to the effectiveness classification criteria, places them within the "very valid" range. Practically, this means the media is not only theoretically sound but also feasible for real-world classroom use, provided that teachers remain actively involved to guide students, particularly during initial implementation.

Table 10. Aspect Criteria Score

No	Aspect	Total Score
1	Compatibility	88.20%
2	Attractiveness	84.10%
3	Comprehensibility	81.22%
4	Convenience	80.59%
5	effectiveness	84.10%
Total	Combined validity	85.34%

DISCUSSION

The findings of this study demonstrate that the use of animal footprint-based instructional media in physical education significantly improves balance, coordination, lower-body strength, and overall motor competence among children with autism. Quantitative results showed a marked increase in average scores from 62.36 to 81.72, with the highest improvement recorded in the two-leg jump (post-test score = 85.12). The paired sample t-test ($p = 0.002 < 0.05$) confirms the statistical significance of these improvements, indicating measurable gains in postural control,

https://doi.org/10.29407/js_unpgri.v11i3.25782
11 (3) 2025| 459-476

agility, and stability-related motor development. These outcomes suggest that multisensory and movement-based approaches effectively enhance motor control, learning engagement, and daily functional abilities such as climbing stairs, maintaining balance, and navigating uneven surfaces with greater confidence.

These findings are consistent with previous research emphasizing the value of adaptive and visual learning tools for neurodiverse students. Atmaja (2019) highlighted that autistic children benefit from instructional media tailored to their motor limitations and sensory needs. Similarly, Ulumudin (2019) and Kellems et al. (2018) found that pictorial and media-based prompts improved learning outcomes, particularly in tasks requiring imitation and sequencing. Delisio and Isenhower (2020) also noted that interactive visual media enhance attention and symbolic recognition. Similarly, Kroncke et al. (2016) and Barry et al. (2025) explained that delays in coordination among autistic learners are often linked to challenges in emotional regulation and task ambiguity, making structured visual cues essential for reducing frustration and promoting consistent participation. Play-based, embodied activities, as reported by Kim et al. (2024), also improve independence among children with disabilities, supporting the results of this study.

The improvement observed in this study can be attributed to the adaptive, structured, and play-based nature of the footprint media, which engages multiple senses through visual and tactile feedback. This multisensory integration process facilitates coordination, reinforces motor planning, and aligns with principles of sensory integration and embodied cognition theory (Wen & Wu, 2025). The repetitive, feedback-oriented design reflects key principles of motor learning, where combining visual and kinesthetic input strengthens learning retention (Kellems et al., 2018; Padmadewi et al., 2023). Compared to modules developed by Kurniawan et al. (2022) that lacked dynamic visual engagement, the animal footprint media used in this study offers a more refined, kinesthetic, and interactive approach that actively guides movement and balance.

Furthermore, the media's colourful and structured design helps maintain attention, reduce anxiety, and promote emotional regulation, key factors influencing motor performance and classroom participation (Barry et al., 2025). From a practical standpoint, the animal footprint media provide a low-cost, high-impact instructional tool that teachers can integrate into regular PE sessions to promote active participation among autistic learners through structured visual and motor cues. Improvements in balance and coordination also translate into greater functional independence in daily tasks while supporting inclusion in group activities and peer play.

This study contributes to both theory and practice by demonstrating how embodied cognition, motor learning, and visual learning principles can be integrated into a simple, poster-based instructional medium. Unlike previous interventions that rely heavily on verbal or cognitive training, this media directly connects visual perception with motor execution, bridging the gap between observation and action. It represents a tangible model of low-technology, embodied instruction capable of fostering meaningful motor improvement within a short intervention period.

Despite its promising outcomes, this study has several limitations. The relatively small and homogeneous sample, short intervention duration, and focus limited to gross motor skills restrict the generalizability of the findings. Participants were drawn from only two schools within a single region, which may not represent the broader diversity of the autism spectrum. Future research should involve larger and more diverse participant groups, extend the duration of media implementation, and examine the long-term retention of motor skills acquired through multisensory and visual kinesthetic interventions. Integrating technological innovations such as augmented reality or motion-tracking systems may further enhance engagement and provide more precise feedback for motor learning.

Therefore, advancing research in adaptive physical education should focus on broader implementation, long-term follow-up, and the exploration of technology-enhanced multisensory tools to strengthen the evidence and

https://doi.org/10.29407/js_unpgri.v11i3.25782
11 (3) 2025| 459-476

expand the practical application of animal footprint-based media as an innovative and inclusive learning solution for children with autism.

CONCLUSION

This study demonstrated that animal footprint-based instructional media effectively improved dynamic balance and basic motor skills among autistic children in Tapin Regency, as evidenced by significant gains on the post-test. The findings reinforce principles of multisensory learning, embodied cognition, and visual learning theory by showing how tactile visual cues and movement-based engagement enhance motor control, coordination, and attention. Practically, the media provide a low-cost, adaptable, and inclusive tool that teachers can integrate into physical education to strengthen functional independence and participation. While the results highlight the media's potential as an evidence-based intervention for adaptive PE, limitations related to sample size, setting, and intervention duration warrant caution. Future research should include more diverse participants, longer implementation periods, and comparative analyses of poster-based versus technology-based media to optimize further and generalize the effectiveness of adaptive motor-learning tools for neurodiverse learners.

REFERENCES

Abadi, R. (2021). The Use of Disability Interactive Media to Improve Beginning Reading for Children with Multiple Disabilities Class III SDLB In SLB Agrowisata Shaleha Panjalu. *IJDS: Indonesian Journal of Disability Studies*, *8*(01), 129–144. https://doi.org/10.21776/ub.ijds.2021.008.01.10

Akbar, S. (2022). *Instrumen Perangkat Pembelajaran*. PT. Remaja Rosdakarya.

Alali, N. N., Carson, H. J., & Collins, D. (2024). A Pragmatic Approach to Skill Acquisition for Physical Education: Considering Cognitive and Ecological Dynamics Perspectives. *Quest*, *76*(2), 227–246. https://doi.org/10.1080/00336297.2023.2298931

Atmaja, J. R. (2019). *Pendidikan dan Bimbingan Anak Berkebutuhan Khusus.* PT Remaja Rosdakarya.

Barry, A., Haegele, J. A., Pickett, K. A., Schaefer, D., & Columna, L. (2025). Autistic young adults' experiences in physical activity: A phenomenological study. *Autism*. https://doi.org/10.1177/13623613251338377

Branch, R. M. (2009). *Instructional Design: The ADDIE Approach*. Springer US. https://doi.org/10.1007/978-0-387-09506-6

Delisio, L. A., & Isenhower, R. W. (2020). Using Video Prompts to Promote Independent Behavior in Students With Autism Spectrum Disorder. *Journal of Special Education Technology*, *35*(3), 167–175. https://doi.org/10.1177/0162643420919179

Dyson, B., Howley, D., & Wright, P. M. (2021). A scoping review critically examining research connecting social and emotional learning with three model-based practices in physical education: Have we been doing this all along? *European Physical Education Review*, *27*(1), 76–95. https://doi.org/10.1177/1356336X20923710

Haegele, J. A., Wilson, W. J., Zhu, X., Bueche, J. J., Brady, E., & Li, C. (2021). Barriers and facilitators to inclusion in integrated physical education: Adapted physical educators' perspectives. *European Physical Education Review*, *27*(2), 297–311. https://doi.org/10.1177/1356336X20944429

Haes, P. E. (2019). KOMUNIKASI INSTRUKSIONAL DALAM PROSES BELAJAR MENGAJAR BAGI ANAK ASD (Autism Spectrum Disorder). *Journal Of Language Education and Development (JLed)*, *1*(2), 112–124. https://doi.org/10.52060/jled.v1i2.141

Kellems, R. O., Frandsen, K., Cardon, T. A., Knight, K., & Andersen, M. (2018). Effectiveness of static pictures vs. video prompting for teaching functional life skills to students with autism spectrum disorders. *Preventing School Failure: Alternative Education for Children and Youth*, *62*(2), 129–139. https://doi.org/10.1080/1045988X.2017.1393790

Kim, S. Y., Udhnani, M., & Lecavalier, L. (2024). Heterogeneity in autism spectrum disorder explained by social-communicative and restricted repetitive behavior balance subgroups. *Research in Autism Spectrum Disorders*, *114*, 102387. https://doi.org/10.1016/j.rasd.2024.102387

Kroncke, A. P., Willard, M., & Huckabee, H. (2016). *Assessment of Autism Spectrum Disorder*. Springer International Publishing. https://doi.org/10.1007/978-3-319-25504-0

Kurniawan, R., Mu'arifin, Kurniawan, A. W., H., F. P., & Sigit, C. N. (2022). *Development of Teacher E-Module for Dynamic Balance Movement for Grade 3 Elementary School with Autism*. https://doi.org/10.2991/ahsr.k.220203.015

Lee, J., & Gutierrez, J. (2023). Computer-Assisted Gamification as an Approach to Support Movement Skills Development in Children with Autism Spectrum Disorder. *Journal of Physical Education, Recreation*

& Dance, *94*(3), 35–40. https://doi.org/10.1080/07303084.2022.2156937

Lewchuk, D. R., D'Amico, M., & Timm-Bottos, J. (2021). Digital Footprints: Exploring Digital Inclusion in Adults With Developmental Disabilities (Empreintes numériques : exploration de l'inclusion numérique chez les adultes ayant une déficience développementale). *Canadian Journal of Art Therapy*, *34*(2), 52–62. https://doi.org/10.1080/26907240.2021.1982171

Liang, Z., Lee, D., Zuo, J., & Liang, S. (2024). The use of visual schedules to increase academic-related on-task behaviors of individuals with autism: a literature review. *International Journal of Developmental Disabilities*, *0*(0), 1–14. https://doi.org/10.1080/20473869.2024.2402124

Orhan, B. E., Karaçam, A., & Özdemir, A. S. (2024). The Effects of Physical Activity in Individuals with Autism Spectrum Disorder: A Qualitative Study. *International Journal of Disabilities Sports and Health Sciences*, *7*(1), 1–12. https://doi.org/10.33438/ijdshs.1315842

O'Neill, G., & Murphy, F. (2010). *Guide to Taxonomies of Learning* (Issue January). UCD TEACHING AND LEARNING.

Padmadewi, N. N., Artini, L. P., Sindu, I. G. P., Shanmuganathan, T., Suarcaya, P., & Dewi, K. S. (2023). Instructional Media for Autistic Spectrum Disorder (ASD) Children: A Study on Need Analysis. *Journal of Education Research and Evaluation*, *7*(3), 477–491. https://doi.org/10.23887/jere.v7i3.61558

Sheppard, D. P., Bruineberg, J. P., Kretschmer-Trendowicz, A., & Altgassen, M. (2018). Prospective memory in autism: theory and literature review. *The Clinical Neuropsychologist*, *32*(5), 748–782. https://doi.org/10.1080/13854046.2018.1435823

Ulumudin, I. (2019). PENGGUNAAN MEDIA GAMBAR UNTUK MENGEMBANGKAN PENGUASAAN KOSAKATA PADA ANAK AUTIS USIA DINI. *JIV-Jurnal Ilmiah Visi*, *14*(1), 75–84. https://doi.org/10.21009/JIV.1401.8

Wen, L., Wu, Z. (2025). The impact of sensory integration-based sports training on motor and social skill development in children with autism spectrum disorder. Sci Rep 15, 19974. https://doi.org/10.1038/s41598-025-05393-3