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Edustory Nature : Outdoor Education-Based Digital Learning Media To Stimulate Motor Skills In Early Childhood

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Abstract

This study aims to analyze the effectiveness of EduStory-Nature, a digital learning media integrating outdoor education principles, in improving gross motor skills in early childhood, as well as to explore teacher and parent perceptions regarding its implementation. A mixed-methods approach was employed, combining a quasi-experimental design to measure changes in motor skills through pre-test and post-test assessments, and a descriptive qualitative design to examine user acceptability. The research subjects consisted of children aged 4–6 years enrolled in early childhood education (PAUD) institutions in Bandung and Cimahi, while teachers and parents served as supporting informants. The results show a significant improvement in gross motor skills among children who used EduStory-Nature. The N-Gain scores reached the high category, namely 0.72 in PAUD A and 0.68 in PAUD B. In contrast, classes without the media only achieved low N-Gain scores (0.24–0.28). These findings indicate that outdoor-based digital learning provides richer sensory experiences, enhances active body movement, and supports more optimal motor development compared to conventional learning. Qualitative data also reveal a high level of acceptability from teachers and parents in terms of relevance, ease of use, visual attractiveness, and alignment with early childhood developmental needs. Overall, EduStory-Nature is proven to be effective in enhancing gross motor skills and increasing children's engagement through the integration of narrative, interactive visuals, and nature-based exploration. Its flexibility of implementation—indoors, outdoors, and at home—further strengthens its practicality for early childhood education settings.

Keywords: *Outdoor Education, Digital Media, Gross Motor Skills, Early Childhood, Edustory-Nature*

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INTRODUCTION

Motor development in early childhood is a crucial aspect that influences a child's overall physical, cognitive, and social growth. The World Health Organization (WHO) guidelines for children aged 0-5 years recommend that children engage in physical activity of any intensity (Bull et al., 2020). Gross motor competence in children provides a positive contribution from fundamental movement skills, supporting competencies in social, cognitive, and affective domains (Karisman & Asmawi, 2021). Outdoor activities are essential for children's motor development, well-being, and health (Roslund et al., 2020). Unfortunately, over the past decade, advancements in digital technology have shifted children's activity patterns from active movement toward sedentary behavior, which threatens their health and motor development (Zink et al., 2024).

Outdoor education is an effort to increase children's learning capacity through learning outside of school (Ramadhan, Kusuma, & Heza, 2024). Meanwhile, the Outdoor Education approach offers learning experiences based on natural exploration, which has been proven to enhance children's gross and fine motor skills. Outdoor learning refers to purposeful and planned experiences conducted outside (Prince, 2019). It is a broad term encompassing discovery, experimentation, learning about, and connecting with the natural world, as well as engaging in outdoor sports and adventure activities. However, its implementation remains limited due to a lack of integration with age-appropriate digital learning media that aligns with contemporary needs. Today's children not only require motor stimulation but also engaging, interactive, and relevant learning approaches that resonate with their digital world.

EduStory-Nature is proposed as an educational digital media concept that combines outdoor-based exploration with interactive narrative technology. This approach has not been extensively studied in empirical contexts; therefore, the research questions in this study are: 1) How effective is the use of EduStory-Nature media in improving early childhood motor skills? 2) What are the perceptions of teachers and parents toward this outdoor education-based digital media in the learning process? and 3) What are the challenges and opportunities in integrating digital media based on outdoor exploration within the context of early childhood education (PAUD)?

The problem-solving approach in this research integrates real-world needs (need-based), stakeholder involvement (participatory), evidence-based methods, and an

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interdisciplinary perspective to develop a conceptual solution in the form of digital learning media that adopts the spirit of outdoor education in urban settings. This research is relatively novel because digital storytelling has previously been limited to enhancing literacy and language skills; thus, EduStory-Nature enables an examination of its impact on the motor domain, particularly gross motor skills, in early childhood. The novelty of this study lies in: (1) integrating outdoor learning with digital media; (2) testing its effects on the motor domain; and (3) being grounded in the local context of PAUD Indonesia.

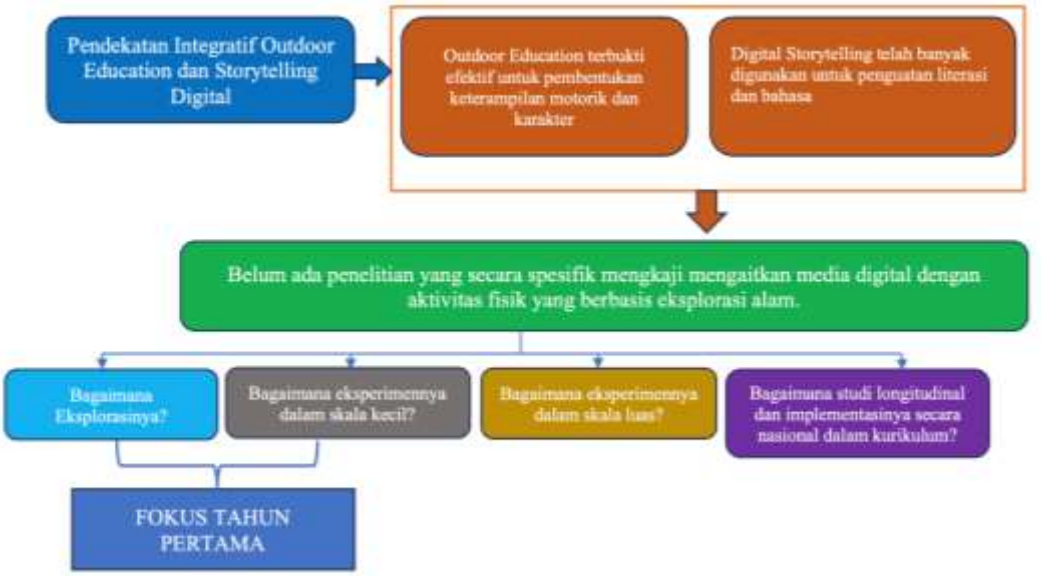


Figure 1. State of the Art of EduStory Nature Research

METHOD

Research method writing contains research design, place and time, population and sample, sampling technique, data measurement technique, and data analysis. It is better to use passive sentences and narrative sentences, not imperative sentences. The research stages are essential as structured steps to achieve the desired objectives and targets of the study. This research employs a mixed-methods approach, incorporating a quantitative perspective with a quasi-experimental design to measure the impact of digital learning media based on outdoor education on early childhood motor skills, as well as a qualitative descriptive approach to explore teachers' and parents' perceptions regarding the acceptability and effectiveness of the media in educational practices. The main subjects are children aged 4–6 years enrolled in early childhood education (PAUD) institutions in

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the cities of Bandung and Cimahi, with supporting informants being PAUD teachers and parents. This study is conducted in several stages, namely :

1. Exploration and Preliminary Study: Conducting a literature review and preliminary study, developing instruments, and coordinating with PAUD institutions.
2. Experimentation: Pre-test and post-test for implementation with and without the EduStory-Nature media.
3. Acceptability Testing: Involving teachers, parents, and participatory observation.
4. Data Analysis: Quantitative (statistical analysis of pre-test and post-test using the N-Gain test); and qualitative through coding and thematic interpretation of interviews and observations.

RESULT

Effectiveness of Using EduStory-Nature Media in Improving Motor Skills in Early Childhood

In this study, researchers conducted an investigation into the implementation of EduStory-Nature media, examining the effectiveness of learning with and without media. The implementation of the media and without media used a pre-test and post-test approach over three months, with each month used to collect as much data as possible, assisted by field assistants.



Figure 2. Implementation of Media EduStory Nature

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To see the comparison between the pre-test and post-test and the implications, the N-Gain Test is carried out using the following formula :

$$N\text{-}Gain = \frac{\bar{X}_{post} - \bar{X}_{pre}}{Skor_{maks} - \bar{X}_{pre}}$$

Figure 3. N-Gain Formula

with the following criteria: high ($g \geq 0.7$), medium ($0.3 \leq g < 0.7$), low ($g < 0.3$). The formula is substituted into the following two conditions :

Analysis of Motor Skill Improvement Without Media

Table 1. Results of N-Gain Calculation Without Media

Group	Pre-Test	Post-Test	N-Gain	Categori
PAUD A	15,1	20,5	0,24	Low
PAUD B	16,0	21,7	0,28	Low close to medium

The results of the N-Gain test in classes without the use of EduStory Nature media showed a relatively low average increase. In Class A without media, the average pretest score was 15.1, increasing to 20.5 on the posttest, with an average N-Gain of 0.24 (in the low category). Meanwhile, in Class B without media, the average pretest score was 16.0, increasing to 21.7 on the posttest, with an average N-Gain of 0.28 (in the low-to-moderate category).

These results indicate that despite improvements in motor skills, the effectiveness of learning without media remains low. Students tend to struggle to understand the material deeply because the learning process is not supported by contextual and engaging media. A study shows that learning without digital media tends to decrease the attention and learning motivation of young children (Yıldırım & Akamca, 2017).

Analysis of Motor Skill Improvement with Media

Table 2. Results of N-Gain Calculations with Media

Group	Pre-Test	Post-Test	N-Gain	Categori
PAUD A	16,3	27,1	0,72	High
PAUD B	15,0	25,6	0,68	High

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Results in classes using EduStory Nature media showed significant improvements. In Class A with Media, the average pretest score of 16.3 increased to 27.1 in the posttest, with an average N-Gain of 0.72 (high category). Meanwhile, in Class B with Media, the average pretest score of 15.0 increased to 25.6, with an average N-Gain of 0.68 (high category).

These findings indicate that EduStory Nature can have a positive impact on improving motor skills in early childhood. Digital-based media and outdoor education provide more meaningful learning experiences through direct interaction with the surrounding environment, while also facilitating children's physical and cognitive activity. This aligns with research that emphasizes that the use of environment-based learning media can improve motor skills and children's engagement in the learning process (Bachtiar, Hasmawaty, Sultan, Asriasi, & Gulzhaina, 2025)

Comparison of Effectiveness

Table 3. Summary of N-Gain for Kindergarten A and Kindergarten B with and without EduStory Nature Media

Group	Pretest (Average)	Posttest (Average)	Average N-Gain	Categori N-Gain
PAUD A – without EduStory	15,1	20,5	0,24	Low
PAUD A – with EduStory	16,3	27,1	0,72	High
PAUD B – without EduStory	16,0	21,7	0,28	Low (close to medium)
PAUD B – with EduStory	15,0	25,6	0,68	High

When compared, it can be seen that the average N-Gain in the class with media is in the high category (0.68–0.72), while in the class without media it is only in the low category (0.24–0.28). This situation can be further clarified by looking at the following graph :

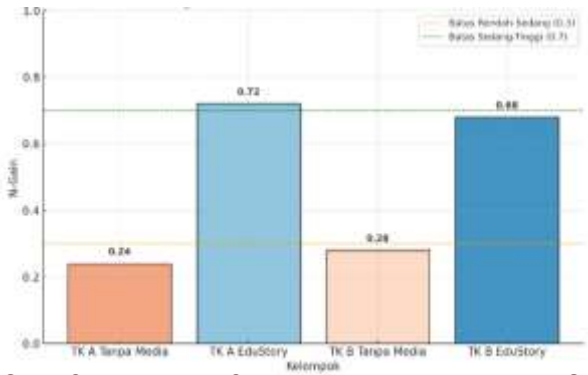


Figure 4. N-Gain Comparison Chart with and without EduStory Nature Media

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The graph is made with a vertical axis that shows the N-Gain value (0 to 1), as well as the category limits: ≥0.7 = High, 0.3–0.7 = Medium, <0.3 = Low also The "With Media" Group (EduStory Nature) is clearly far above the group without media. Thus, it can be concluded that the implementation of EduStory Nature is much more effective in improving early childhood motor skills compared to conventional learning without media.

Teacher and Parent Acceptance Test

The acceptability of the EduStory Nature media in early childhood education (PAUD) learning, as perceived by both teachers and parents, consists of several thematic categories, namely :

1. Acceptability of the Media by Teachers and Parents
2. Media Appeal and Educational Value
3. Learning Effectiveness and Motor Skill Stimulation
4. Ease of Implementation and Flexibility of Use
5. Challenges and Suggestions for Improvement

The resulting data are then presented in the form of a thematic matrix to clarify the relationships among the findings.

Table 4. Thematic Matrix of Teacher and Parent Perception Analysis

Theme	Description of Findings	Representative Quotes
Media Acceptability	The media is considered relevant to children's motor development and easy to integrate.	"Very relevant to child development."
Media Attraction	Stories and natural elements capture children's attention; increase focus and participation.	"The response was so enthusiastic! They got involved right away."
Motor Effectiveness	Activities in media help improve gross motor skills significantly.	"Gross motor skills are showing signs of development."
Ease of Implementation	Teachers and parents find the media easy to use in the classroom and at home.	"Easy to use at home."
Usage Constraints	Some movements take some getting used to; the end of the video is a bit fast	"Some movements need to be adjusted."

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DISCUSSION

The Effectiveness of Using Edustory-Nature Media in Improving Motor Skills in Early Childhood

A clear difference in the effectiveness of motor skill improvement is seen between the groups using the EduStory Nature media and those without media use in both early childhood education groups (PAUD A and PAUD B). The average N-Gain score for PAUD A with media reached 0.72, and for PAUD B with media 0.68—both categorized as high. In contrast, the groups without media only obtained N-Gain scores of 0.24 (PAUD A) and 0.28 (PAUD B), which fall into the low category. These findings indicate that using digital outdoor-education-based media can accelerate the improvement of gross motor skills in young children.

This difference demonstrates that digital learning media based on outdoor education, such as EduStory Nature, provides significant opportunities for enhancing motor skills. This media not only increases higher posttest scores but also maximizes developmental potential from pretest to posttest, as reflected in the denominator of the N-Gain formula, which accounts for the “distance” from the maximum score.

These results are consistent with findings from meta-analysis studies stating that exercises focused on motor development consistently produce substantial improvements in gross motor skills among young children (Kadek et al., 2025). Digital outdoor-education-based media like EduStory Nature provide richer and more interactive learning experiences, making children more active and improving coordination, balance, and motor strength. This aligns with research emphasizing the importance of outdoor learning activities for children’s gross motor development (Tonge, Jones, & Okely, 2016).

Furthermore, learning that incorporates outdoor play and environmental exploration supports gross motor development through both structured and unstructured physical activities (Cheung, Ostrosky, Favazza, Stalega, & Yang, 2023). The local context also strengthens these results, as evidenced by the use of traditional obstacle games that have been proven to improve gross motor skills in early childhood in Indonesia (Caldwell et al., 2022).

Thus, EduStory Nature is not only relevant as a digital innovation but also as a tool to stimulate gross motor activity through nature-based learning experiences. These findings support the idea that outdoor learning integrated with technology has a more

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effective impact compared to conventional learning methods (Margaretha, Sulistiana, & Marshanda, 2024). Overall, this study confirms that digital outdoor-based learning interventions can significantly enhance children's gross motor skills compared with traditional methods. This reinforces the need for innovative learning media development in early childhood education institutions to support optimal child growth and development.

The effectiveness of the N-Gain results is further supported by observational findings, where improved body movement coordination and balance indicate that children benefited from the interactive visual and instructional activities provided by EduStory Nature. These findings align with research stating that motor exercises based on play significantly improve children's gross motor skills (Ghosh, 2024). In the aspects of muscle strength and agility, outdoor activities supported by interactive media allow children to jump, run, and move with more varied challenges, providing more effective stimulation for large muscles. This is consistent with research highlighting the importance of free outdoor play in supporting children's gross motor development (Barbosa & de Oliveira, 2016).

Beyond motor skills, children's participation also increased, as shown by heightened enthusiasm and improved social interaction, consistent with studies indicating that traditional outdoor games not only enhance gross motor skills but also foster social cooperation (Salaman, 2025). The improvement of children's gross motor skills through EduStory Nature is also in line with Yuliani's emphasis on the effectiveness of outdoor learning integrated with local culture in strengthening children's muscles and balance (Yuliani, Antara, & Magta, 2017). Moreover, a study shows that well-developed gross motor skills correlate with children's readiness for formal learning in primary school (Bardid et al., 2017). EduStory Nature has proven to be more effective than learning without media in improving gross motor skills and social participation in early childhood

User Acceptance of Edustory-Nature Media in Improving Motor Skills of Early Childhood

Teachers and parents showed a high level of acceptance, which contributed to: 1) consistent use of the media, 2) children's engagement, and 3) the quality of implementation. The *EduStory Nature* media was considered highly suitable for use in early childhood education because it aligns with the developmental needs of young children. High acceptance from teachers and parents is a key factor in the successful

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implementation of learning media (Kim, Park, & Jang, 2019). User perceptions greatly influence the sustainability of digital media use in early childhood education (Liu & Birkeland, 2022). This level of acceptance is an important factor in the success of digital learning media. It also supports the Technology Acceptance Model (TAM), which emphasizes that perceived usefulness and ease of use directly influence the acceptance of educational technology.

Nature-based narratives and exploratory activities helped children become more focused and enthusiastic. Recent research shows that story-based digital media can increase engagement in young children because they connect the narrative with real-life experiences (Putri & Santoso, 2022). Nature-oriented stories and activities provide more contextual learning experiences. Teachers stated that: “Children understand concepts more easily when the movements are related to nature.”

This reinforces the principle that outdoor-based learning supports the development of motor and socio-emotional skills. The integration of natural elements also aligns with outdoor learning theory, which states that contact with nature enhances creativity, concentration, and physical health (Sari et al., 2023). Teachers and parents agreed that this media supports improvements in gross motor skills. These observations are consistent with quantitative analysis results (high N-Gain). International research also notes that movement-based activities such as jumping, running, and balancing are essential components of gross motor development (Chen et al., 2021). The media’s ability to be used in various settings—indoor, outdoor, and at home—is highly important in early childhood education. Flexible media increases opportunities for continuous learning practice (Hwang, 2021). In the post-pandemic era, media flexibility has become a new standard in education (Alam et al., 2022).

The implementation and use of EduStory Nature did not run smoothly without challenges. The obstacles encountered were technical in nature but easy to resolve. Issues such as video duration or movement adaptation are common findings in digital media research for young children (Rahman et al., 2022). This means that, overall, the media is highly feasible and effective, with only minor improvements needed.

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CONCLUSION

This study concludes that EduStory-Nature, a digital learning media integrating outdoor education principles, is highly effective in enhancing gross motor skills in early childhood. The quasi-experimental results demonstrate a significant difference between children who used EduStory-Nature and those who learned without media. The N-Gain scores in classes using the media fall within the *high* category (0.68–0.72), whereas classes without the media remain in the *low* category (0.24–0.28). This indicates that outdoor-based digital learning provides richer sensory experiences, encourages active body movement, and supports more optimal motor development compared to conventional learning.

Teacher and parent perception analysis further reinforces the effectiveness of EduStory-Nature. High acceptability was shown in terms of relevance, usability, attractiveness, and alignment with early childhood developmental needs. The media's integration of narrative, natural elements, and exploratory activities successfully increased children's engagement, motivation, and participation. Moreover, the flexibility of implementation—usable indoors, outdoors, and at home—enhances its practical value in early childhood education settings.

Although some minor challenges were encountered, such as movement adjustments and video pacing, these did not hinder the overall implementation. Both quantitative and qualitative findings consistently show that EduStory-Nature not only improves gross motor skills but also supports children's focus, enthusiasm, and social interaction. This research emphasizes the importance of combining digital storytelling with nature-based exploration as an innovative approach to early childhood learning.

Overall, EduStory-Nature offers a promising model for digital outdoor education in PAUD Indonesia. It contributes new insights to the field by demonstrating that digital storytelling—traditionally focused on literacy—can be effectively expanded to support motor development. Future studies are encouraged to refine the media, explore its long-term impact, and test its scalability across diverse educational contexts.

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