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Development of the Bolinum Game to Enhance Literacy and Social Skills in 4-5 Year Old Children

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Abstract: This study aims to develop and evaluate the effectiveness of the Bolinum game in enhancing literacy and social skills in children aged 4-5 years at TK IT Almawaddah. The game is designed to integrate basic literacy learning (letter and number recognition) with social skill development (such as sharing, taking turns, and cooperation) in an interactive and enjoyable manner. The research utilizes a mixed-method approach, combining pre- and post-tests, observational assessments, and feedback from educators and children. The findings indicate that the Bolinum game significantly improved both literacy skills and social behaviors in the children, with literacy scores increasing from 60% to 85% and social skills from 58% to 80%. The game was also validated by experts, achieving a high validation score of 88%. Positive responses from both children and teachers suggest that the game successfully engaged students and facilitated active participation in learning activities. The study highlights the potential of game-based learning in early childhood education, providing an innovative, cost-effective, and engaging way to promote cognitive and social-emotional development in young children. Future research could focus on long-term impacts and broader implementation in different educational settings.

Keywords: bolinum; literacy; social skills; game-based learning; early childhood education; inclusion.

INTRODUCTION

Play is an essential activity in early childhood development; in this context, play is not merely a form of entertainment but also an effective learning medium that stimulates various developmental aspects, including children's cognitive, socio-emotional, and motor development (Nilsson, Ferholt, & Lecusay, 2018). International research shows that facilitated play interventions can improve early literacy as well as social skills among young children (Mwinsa & Dagada, 2025; Salimi & Fauziah, 2023). At the age of 4 to 5 years, children begin to show significant language development such as the ability to speak in more complex sentences and recognize new vocabulary (Widayati, Safrina, & Supriyati, 2020). This is also a critical period for phonological awareness and pre-literacy processes, which serve as the foundation for future reading skills (Yulia & Eliza, 2021; Choiriyah, Widiati, & Emiliana, 2023). Early childhood literacy is influenced by interactions with the environment, including talking, shared reading, and play (Vygotsky, 2023; Snow, Burns, & Griffin, 2021). In inclusive early childhood settings, literacy delays may manifest not only in typically developing children but also in children with language disorders, intellectual disabilities, or developmental delays, highlighting the need for literacy media accessible to diverse learners.

In addition to literacy, social development in early childhood is essential because children learn how to interact, share, collaborate, and solve conflicts productively (Ramadani & Hikmah, 2024; Salimi & Fauziah, 2023). Games involving social interaction can promote communication, cooperation, empathy, and peer relationship building (Swasthi, Suryawan, & Putri, 2024). Social attitudes emerge through interactions with peers, families, and teachers (Sendil & Erden, 2022). Within inclusive learning environments, social challenges become more complex, as children with disabilities such as ASD, ADHD, or speech delays may struggle with communication, self-regulation, and peer engagement. Therefore, structured play activities that promote guided interaction and peer-mediated learning are essential for ensuring meaningful participation for all children.

Play supports physical, cognitive, social, and emotional development (Mutiah, 2020; Hurlock, 2021). Vygotsky (2023) highlights that play contributes to the development of higher psychological functions, including language and problem-solving. Educational play enables children to explore, be creative, and develop social skills (Nilsson et al., 2018). Ardini and Lestariningrum (2023) emphasize that play enhances various developmental aspects when designed according to children's developmental stages. Educational Play Tools (APE) such as bowling games can support motor, cognitive, and socio-emotional development (Sujiono, 2021; Mulyani, 2023). Bolinum integrates literacy and numeracy elements into modified bowling games (Mulyani, 2023; Sujiono, 2020). Aligned with Universal Design for Learning (UDL), Bolinum can be adapted through multiple means of representation (visual cues, tactile prompts), engagement (turn-taking, collaborative modes), and expression (verbal responses, pointing), making it accessible for diverse learners, including children with mild disabilities or developmental delays.

Modified bowling games can combine motor, literacy, and social aspects in enjoyable learning (Nilsson et al., 2018; Ardini & Lestariningrum, 2023). Prior studies have shown benefits for numeracy (Fara, Wondal, & Mahmud, 2020) and motor development (Samhani, Ali, & Hanifah, 2025). However, the use of bowling or similar interactive media to simultaneously stimulate pre-literacy and social attitudes in 4–5-year-old children is still limited (Choiriyah et al., 2023; Mwinsa & Dagada, 2025). More importantly, almost no studies conceptualize bowling-based learning tools as inclusive educational media that address accessibility, peer interaction, and equitable participation an essential requirement for early childhood settings that include children with disabilities.

Based on observations at TK IT Almawaddah, 80% of children aged 4–5 years had not yet mastered basic literacy skills and 80% had not yet demonstrated adequate social attitudes. These challenges may be even more pronounced for children experiencing learning barriers or developmental delays, reinforcing the need for accessible and inclusive play-based learning tools.

This study aims to develop the Bolinum Game, a variation of bowling designed for children aged 4–5 years. Through this game, children are expected to receive stimulation in literacy, number recognition, and key social skills such as communication, cooperation, and empathy. By framing Bolinum as an inclusive, UDL-based play intervention, this research seeks to expand its relevance beyond a single school context and contribute to broader early childhood inclusion practices.

METHOD

This study employs a Research and Development (R&D) approach to produce the Bolinum learning tool designed to enhance literacy skills and social attitudes among children aged 4–5 years at TK IT Almawaddah. The ADDIE model (Analysis, Design, Development, Implementation, and Evaluation) was used because it provides a systematic framework for developing and validating educational media (Sugiyono, 2019; Panjaitan & Rasyid, 2023). The aim of this study is to create an innovative learning tool that responds to challenges in early childhood literacy and social behavior development (Waruwu, 2024), and the R&D process includes phases of product design, expert validation, and limited field trials to ensure feasibility and effectiveness (Anugrah, Chairilsyah, & Puspitasari, 2021).

The ADDIE procedure began with an analysis phase in which researchers conducted needs analysis through classroom observations and interviews with teachers to identify difficulties children faced in acquiring literacy and social skills, while also reviewing curriculum standards for children aged 4–5 years (Widayati, Safrina, & Supriyati, 2021). This stage also incorporated an assessment of diverse learning needs, ensuring that the

design responded to children with mild developmental delays in accordance with inclusive early childhood education principles. In the design phase, the Bolinum tool was constructed with indicators aligned to literacy development such as letter recognition and phonological awareness and social attitudes, including cooperation and responsibility (Sujiono, 2021; Mulyani, 2023). The design process also adopted Universal Design for Learning (UDL) elements such as visual cues, simplified rules, and turn-taking scaffolds to ensure accessibility for all learners. During the development phase, the initial prototype was produced using simple materials such as used bottles and origami paper, followed by expert review and refinement to ensure developmental suitability (Sujiono, 2021; Waruwu, 2024). The implementation phase involved a limited trial with children in the TK A3 group, during which researchers observed children's engagement, letter pronunciation, and social interactions while using Bolinum (Ardini & Lestariningrum, 2023). The final phase, evaluation, assessed the effectiveness of the tool and gathered feedback from teachers and experts for further improvement (Anugrah et al., 2021), with triangulated assessments to minimize evaluator subjectivity.

To support systematic measurement, operational definitions were established for literacy and social skills. Literacy was defined as the ability to recognize letters, identify initial sounds, and pronounce simple words (Choiriyah et al., 2023; Snow et al., 2021), while social skills referred to children's ability to communicate, cooperate, take turns, and exhibit empathy (Ramadani & Hikmah, 2024; Swasthi et al., 2024). Each construct was scored on a three-level rubric (3 = consistent behavior, 2 = occasional behavior, 1 = minimal behavior), enabling use with children across different developmental profiles. Two trained observers independently rated children's performance, and inter-rater reliability was examined using Cohen's kappa. Efforts to reduce observer bias included structured scoring guidelines, observer training, and blind scoring where feasible.

Data collection was carried out using several techniques, including questionnaires to identify initial learning needs and gather responses during validation (Sugiyono, 2019; Arikunto, 2018), direct observation of children's engagement and behavior (Moleong, 2017), and interviews with teachers, parents, and experts to gain deeper insights into their experiences with Bolinum (Moleong, 2017; Panjaitan & Rasyid, 2023). Documentation such as photographs, teacher notes, and learning outcome records was used to support qualitative findings (Sugiyono, 2019). Learning assessments were conducted through pretest and posttest procedures to measure changes in literacy and early reading skills (Arsyad, 2017; Wardhani, Iriyanto, & Maningtyas, 2021). In line with inclusive education considerations, the instruments were adapted to remain accessible for children with slower processing speeds or communication challenges, ensuring equitable participation in all assessment procedures.

The research subjects comprised 15 children aged 4–5 years from the TK A3 class. Although the sample is small, this size is typical for early-phase R&D studies focusing on feasibility and media prototype refinement. Teachers were included as respondents to provide feedback on practicality and classroom application of the Bolinum tool. Data were analyzed through qualitative description to identify learning needs and user experiences, along with quantitative analysis to assess media validity based on expert evaluations. Practicality assessments were drawn from teacher and student responses concerning usability and implementation feasibility. The effectiveness of Bolinum was analyzed through pretest–posttest score comparisons. A paired samples t-test was employed because the same group was evaluated before and after the intervention; although the sample size is small (n=15), this method is appropriate for pilot studies when assumptions such as normality are

tested using Shapiro–Wilk, and the reporting of effect size compensates for limited statistical power. Learning improvement was further analyzed using N-Gain scores to quantify progress over time.

Ethical procedures were strictly followed. Ethical clearance was obtained from the institutional ethics committee, and written parental consent as well as verbal child assent were collected prior to data collection. All participant identities were anonymized, and activities ensured children's psychological comfort and safety. Moreover, the Bolinum tool was explicitly designed to be inclusive by integrating UDL principles (multiple means of representation, engagement, and expression) and by offering scaffolding for children with mild speech delays, attention regulation difficulties, or slower learning paces. This commitment strengthens the relevance of the study for inclusive early childhood education.

FINDING AND DISCUSSION

Finding(s)

TK IT Almawaddah is an early childhood education institution located in Semarang that is committed to providing holistic educational services through a Deep Learning approach. Established in 2008, the school emphasizes the development of the whole child through a curriculum aligned with contemporary advancements and integrated with Islamic values. Following its transformation in 2025, TK IT Almawaddah adopted the Deep Learning approach, positioning children as active and creative learners while attending to all aspects of development, including physical, cognitive, social, and emotional domains.

This research follows the ADDIE model (Analysis, Design, Development, Implementation, and Evaluation), which consists of five essential stages. Each stage was carried out systematically to develop the Bolinum game, which is expected to enhance literacy skills and social attitudes of children aged 4–5 years at TK IT Almawaddah. The detailed explanation of each stage is presented below, along with the relevant tables.

Analysis

The analysis stage involved identifying problems and needs to develop a learning media suitable for early childhood characteristics at TK IT Almawaddah. This analysis included observing current conditions, such as children's difficulties in recognizing letters and numbers, as well as social skills including cooperation and communication.

Table 1. Results of Learning Needs Observation

Aspect Analyzed	Observation Findings
Literacy Skills	Many children were still unable to recognize letters and numbers well.
Social Skills	Children experienced difficulties interacting with peers, such as sharing and taking turns.
Existing Curriculum	The literacy and social curriculum did not include enjoyable and interactive methods.

Design

During the design stage, the Bolinum game was conceptualized by integrating bowling elements with literacy and social activities. The game design considered children's cognitive and social development, where each pin contained letters or numbers that the children had to identify. The game was also structured to encourage cooperation, sharing, and turn-taking.

Table 2. Design of the Bolinum Learning Tool

Game Element	Description
Materials	Plastic ball, pins containing numbers and letters, game board.
Function	Introducing letters and numbers while training children's social skills.
Game Rules	Children must knock down pins with the ball and mention the letter/number shown on the pin.
Social Activities	Playing in small groups, taking turns, and helping one another.

Development

In the development stage, a prototype of the Bolinum game was created. The prototype was tested to ensure its quality and effectiveness in developing literacy skills and social attitudes. After the prototype was completed, the Bolinum game was evaluated by media experts, content experts, and early childhood practitioners to ensure its alignment with the curriculum and children's enjoyment.

Table 3. Development and Prototype Evaluation Process

Development Step	Activity
Prototype Creation	Creating plastic balls and labeled pins with letters and numbers.
Expert Evaluation	Submitting the prototype to material experts and media experts for validation.
Trial	Testing the prototype with a small group of children in a limited trial.
Feedback	Receiving input from teachers and children to improve the prototype.

Implementation

Implementation was carried out over two weeks through eight learning sessions. Each session lasted 30–40 minutes. Children were divided into small groups to ensure active participation. During implementation, the Bolinum game was used within thematic learning units titled "Myself," "My Environment," and "My Family."

Table 4. Implementation Plan for Bolinum Media

Day	Learning Theme	Activities
1	Myself	Children played Bolinum focusing on letter and number recognition.
2	My Environment	Children played together to improve social skills such as sharing.
3	My Family	Children learned number recognition through bowling activities by naming the numbers displayed.

Evaluation

Evaluation was conducted to measure the effectiveness of Bolinum in improving children's literacy skills and social attitudes. A paired sample t-test was used to compare pretest and posttest scores, while observations and questionnaires were administered to gather qualitative feedback from teachers and children. To strengthen the statistical analysis, an effect size calculation using Cohen's d was added. The effect size for literacy improvement was d = 1.42, and for social attitude improvement d = 1.27, both categorized as large effects, indicating strong practical significance beyond statistical differences. The quantitative results are summarized in Table 5.

Table 5. Evaluation Results of Literacy and Social Skills

Indicator	Pretest Score	Posttest Score	Improvement (%)
Literacy Skills	60%	85%	25%
Social Attitudes	58%	80%	22%

The evaluation results indicate significant improvements in both literacy skills and social attitudes following the use of Bolinum. The paired sample t-test produced a p-value < 0.05, confirming a statistically significant difference between pretest and posttest scores, supported by large effect sizes that demonstrate strong practical impact.

Interpretation of Findings

Concrete improvements were observed during implementation. Children began: (1) voluntarily returning the ball to peers after each turn, (2) reminding friends about turn-taking ("Sekarang kamu dulu, nanti aku ya"), (3) helping peers identify letters and numbers on the pins, (4) showing willingness to share the ball and invite friends to play. These behaviors suggest that improvement in social attitudes was not caused solely by repetition of activities but by the cooperative structure of the Bolinum game. Cooperative play naturally reinforced sharing, communication, and waiting for turns key elements of social-emotional development. Engagement also increased because the game involved movement, challenge, and playful competition, which enhanced intrinsic motivation.

The findings were not uniformly positive across all children. Three children showed slower progress in identifying letters and numbers and needed repeated prompts from teachers. Meanwhile, two children with higher initial literacy mastery quickly completed the tasks and required more complex variations (e.g., identifying beginning sounds or counting knocked-down pins). This variability indicates that while Bolinum is effective overall, children benefit differently based on their initial skill levels. It highlights the need for differentiated instruction within game-based learning.

Although this study did not specifically involve children with disabilities, several children demonstrated diverse learning preferences requiring adaptation. For instance: (1) children who struggled with verbal expression responded better when teachers modeled answers, (2) children who needed visual structure benefited from step-by-step picture guides added during revision, (3) children with sensory sensitivity were more comfortable in quieter, smaller-group sessions, (4) children with limited attention spans stayed engaged when the rules were simplified and turns were shortened. These findings suggest that the Bolinum game has strong potential for inclusive application, provided teachers incorporate visual supports, simplified instructions, communication scaffolds, or sensory accommodations. This aligns with inclusive learning principles such as flexibility, accessibility, and Universal Design for Learning (UDL).

Although the validation results were high (average 88%), classroom observations revealed that some children relied heavily on teacher scaffolding to stay focused. Some children became distracted during longer waiting times, indicating that the practicality score may overestimate ease of use. These observations emphasize that continuous refinement is still needed to ensure consistent engagement for diverse learner profiles

Effectiveness of the Bolinum Media

The results showed significant improvements in both literacy and social attitudes. Before using the media, children recognized an average of 60% of letters and numbers. After two weeks of implementation, this increased to 85%. Social attitudes improved from 58% to 80%.

Beyond statistical significance ($p < 0.05$), the effect size analysis demonstrates strong practical impact: (1) Literacy improvement: Cohen's $d = 1.42$ (large), (2) Social skills improvement: Cohen's $d = 1.27$ (large). These values indicate that the Bolinum game produced meaningful learning gains. Daily observations also support these findings. Children not only recognized letters more confidently but also displayed stronger

communication and social engagement. Teachers noted that previously shy children began volunteering answers, and children who rarely interacted with peers were observed collaborating during the game

Children's and Teachers' Responses

Teachers emphasized that the game increased children's focus and motivation, particularly because learning occurred through movement-based, play-oriented activities. Teachers also described that the game helped reduce classroom conflicts, as turn-taking rules were clearly embedded in gameplay. Children reported that they enjoyed the activity because it felt like playing rather than "belajar biasa." One child said, "Aku suka main bola karena bisa belajar huruf sambil main sama teman-teman," demonstrating increased intrinsic motivation.

Overall, the Bolinum game effectively improved literacy and social attitudes, supported by both statistical significance and large effect sizes. However, the findings also reveal differences in children's responses, underscoring the importance of differentiated instruction. The cooperative nature of the game, combined with repeated exposure and teacher facilitation, played a key role in children's improvement. The study also identifies pathways for future inclusive application, particularly through adaptations for learners who need visual supports, simplified instructions, sensory accommodations, or structured communication scaffolds.

Discussion

Characteristics of the Bolinum Game to Enhance Literacy and Social Skills

The Bolinum game is designed to combine educational and recreational elements aimed at improving the literacy abilities and social attitudes of children aged 4–5 years. Prior studies indicate that game-based learning can significantly enhance early childhood cognitive, social, and motivational development through active engagement and peer interaction (Alotaibi, 2024; Mwinsa, 2025). Its interactive and participatory design enables children to learn while taking turns and collaborating, thereby supporting their socio-emotional development (Hibana, Nayla & Nurhayati, 2024; Suryaningsih & Aisyah, 2024).

The flexible nature of the Bolinum game allows teachers to modify rules based on children's developmental progress. This is consistent with research showing that technology-based and collaborative games can simultaneously enhance literacy and cooperation (Suryaningsih & Aisyah, 2024; Asmawati & Mahabbati, 2025). Consequently, Bolinum supports the development of literacy skills (Latifah, Suriansyah & Amelia, 2025; Wardani et al., 2022) and promotes cooperation, sharing, and empathy (Sari, 2025; Aksoy & Baran, 2024).

Research further confirms that literacy-focused play activities, such as those embedded in Bolinum, improve language development, while physical play strengthens collaboration and social interaction (Rand & Morrow, 2021; González-Gonzále, Guzmán-Franco & Infante-Moro, 2019). Through engaging and enjoyable play experiences, the game promotes early literacy concepts and social skills (Hartt, Hosseini & Mostafapoue, 2020; Hijab et al., 2022).

Additionally, the adaptable structure of Bolinum aligns with the principles of Universal Design for Learning (UDL), particularly in offering multiple means of representation, action-expression, and engagement. These features allow children with different ability levels to participate meaningfully, indicating that the game holds potential for broader application within inclusive early childhood settings.

Validity of the Bolinum Game for Enhancing Literacy and Social Skills

The validity of the Bolinum game reached an average score of 88%, categorized as highly valid. This suggests that its design, content, and implementation align well with the pedagogical standards of early childhood education (Suyadi, 2021; Mulyani, 2023). High validity scores are also in line with arguments that effective educational media should balance instructional quality with enjoyment, thereby enhancing children's engagement (Maureen, Meij & Jong, 2020; Wohlwend, 2023). Technology-based and collaborative learning tools have been shown to promote communication and cooperation—key elements embedded in the Bolinum game (Saputri & Wulandari, 2024).

Furthermore, educational games that integrate cognitive and social dimensions support children's interactions and developmental needs (Lamrani & AbdelWahed, 2020; Guo, 2023). Well-structured game-based learning has been shown to foster both literacy and social attitudes (Putri & Wulandari, 2024). Traditional games involving rules and collaboration also enhance cooperation, empathy, and leadership (Sari, 2025; Mwariko & Kuniati, 2023).

Despite strong validity outcomes, several considerations emerge. The sample was relatively small and homogeneous, and the absence of a comparison group limits the extent to which the observed effects can be attributed solely to the game. Potential rater familiarity with the school context may also introduce bias. These factors highlight the need for cautious interpretation and point toward opportunities for strengthening future validations.

Effectiveness of the Bolinum Game in Improving Literacy and Social Skills

This study demonstrates that the Bolinum game is effective in improving literacy and social attitudes among children aged 4–5 years. Literacy scores increased from 60% to 85% after eight learning sessions, supporting the idea that literacy-based games provide enjoyable opportunities for introducing letters and numbers (Meno, Sada & Qondias, 2024; Suyadi, 2021; Darmayanti & Farida, 2025). Social attitude scores also rose from 58% to 80%, consistent with evidence that collaborative games enhance sharing, turn-taking, and teamwork (Melati & Maghfirah, 2025; Emiyati et al., 2024).

The observed improvements are comparable to findings from other literacy-oriented game interventions, which show gains in phonological awareness, symbol recognition, and oral language development (Rand & Morrow, 2021; González-Gonzále et al., 2019). However, the short intervention period may mean that teacher facilitation contributed significantly to the gains, a dynamic commonly reported in early childhood game-based learning research.

Teacher facilitation played a crucial role in sustaining children's engagement and guiding them through gameplay. Studies emphasize that effective adult scaffolding is essential for ensuring that educational games function optimally (Emiyati et al., 2024; Guo, 2023; Porter et al., 2025). Enjoyable learning experiences further enhance literacy and social development (Guo, 2022; Musyaddad, 2019).

From an inclusion perspective, Bolinum shows potential for adaptation to meet diverse learning needs. Children with motor difficulties could use lighter balls; children with communication challenges may benefit from visual prompt cards; and children with attention-related needs could experience the game in small-group settings. These adaptations align with inclusive play design principles and reinforce the game's suitability for learners with varying abilities.

Children's and Educators' Responses to Bolinum Game

Children responded positively to the Bolinum game, with 85% reporting enjoyment and increased interest. They perceived the game as play rather than structured learning, supporting the idea that games can enhance intrinsic motivation in literacy development. Collaborative gameplay has also been shown to strengthen social interaction and belonging (Behbamnia et al., 2023).

Teachers expressed similarly positive views, reporting improved cooperation, communication, and engagement among children. Effective facilitation by teachers contributes to positive socio-emotional and cognitive outcomes (Behbamnia et al., 2023). Interaction-based games encourage confidence, peer communication, and pro-social values (Marlina, Maruddani, Dewi & Syafitrah, 2025; Ribeiro, Beca & Arenta, 2022).

Overall, the Bolinum game supports literacy and social development while providing meaningful and enjoyable learning experiences (Marlima et al., 2022).

The positive responses from both teachers and children indicate that Bolinum has strong potential for broader implementation in inclusive settings. Adaptations such as high-contrast visuals, multimodal instructions, reduced motor demands, and tiered difficulty levels can further expand accessibility for children with differing abilities. Nevertheless, the short implementation period, absence of a comparison group, and homogeneous sample limit generalizability, underscoring the need for more extensive and diverse future studies.

CONCLUSION

This study demonstrates that the Bolinum play-based learning media is valid, practical, and effective in enhancing the literacy skills and social attitudes of children aged 4–5 years at TK IT Almawaddah. Developed through the ADDIE model, Bolinum was systematically designed to align with the developmental characteristics of early childhood and integrated into enjoyable play activities. The validation results from media experts, material experts, and early childhood practitioners yielded an average score of 88%, indicating a very high level of feasibility. Implementation across eight learning sessions resulted in significant improvements in both literacy (from 60% to 85%) and social attitudes (from 58% to 80%), supported by statistical findings with $p < 0.05$. Positive responses from both children and teachers further confirmed that Bolinum is not only engaging and easy to use but also capable of fostering collaborative learning experiences that promote active participation, self-confidence, and peer interaction. Thus, Bolinum serves as an effective and enjoyable alternative learning medium to support early childhood literacy and social development.

This study offers notable novelty in the development of game-based learning media for children aged 4–5 years, particularly in the domains of literacy and social development. One of the main contributions of this research is the creation of Bolinum, a learning game that integrates basic literacy skills (letter and number recognition) with social skill development (such as sharing, turn-taking, and cooperation). The learning media was designed based on principles of playful and interactive learning, which are essential in early childhood education. This study also emphasizes the use of adaptable physical games that can be adjusted to children's ability levels, thereby supporting not only academic skills but also social engagement. By combining elements of both traditional and modern games, Bolinum presents an innovative learning model that can be widely implemented in early childhood education.

Despite its strengths, this study has several limitations that should be considered. One limitation is the small sample size, which was restricted to children from a single school. Consequently, the findings may not fully represent broader populations. Future research should include larger and more diverse samples to examine whether Bolinum can be effectively applied across various educational contexts. Additionally, although Bolinum proved effective in enhancing literacy and social skills, the study did not explore the long-term impact of using the game. Future studies are encouraged to conduct longitudinal observations to determine whether the positive outcomes found in this research persist over time and continue to influence children's development.

A further limitation concerns the extent to which the findings reflect inclusive classroom conditions. The study did not involve children with disabilities or learners with distinct developmental needs; therefore, the generalizability of Bolinum for inclusive educational settings remains limited. Future research should include more diverse populations such as children with developmental delays, communication disorders, or sensory needs to evaluate whether the game is equally beneficial for these groups.

Recommendations for future research include developing more diverse game variations that address not only literacy and social skills but also domains such as motor skills, emotional development, and creativity. Furthermore, subsequent studies should consider involving families to investigate whether parental participation in game-based learning activities can further strengthen the positive effects of Bolinum on children. Future research should also explore gender differences and socioeconomic factors to ensure that the developed learning media provides equitable benefits for all children.

In addition to these directions, the scalability of Bolinum should also be explored, particularly in relation to its adaptation for different classroom sizes, varying teacher capacities, and diverse educational contexts. Future studies are encouraged to design and test inclusive versions of the game that incorporate accessibility features such as tactile elements, simplified instructions, visual supports, and adjustable difficulty levels so that children with different abilities, including those with disabilities, can participate meaningfully. By emphasizing adaptability and universal design, Bolinum has the potential to support inclusive classroom practices and become a scalable learning tool that aligns with the broader goals of equitable early childhood education.

REFERENCES

Aksoy, P., & Baran, G. (2020). The effect of storytelling-based and play-based social skills training on social skills of kindergarten children: An experimental study. *Education and Science, 45*(204), 157–183. https://doi.org/10.15390/EB.2020.8670

Alotaibi, M. S. (2024). Game-based learning in early childhood education: A systematic review and meta-analysis. *Frontiers in Psychology, 15*, 1307881. https://doi.org/10.3389/fpsyg.2024.1307881

Anugrah, D. P., Chairilsyah, D., & Puspitasari, E. (2021). Pengembangan media busy board untuk meningkatkan kemampuan motorik halus anak usia 4–5 tahun di RA Al-Hidayah Pekanbaru [Development of Busy Board Media to Improve Fine Motor Skills of Children Aged 4–5 Years at RA Al-Hidayah Pekanbaru]. *Jurnal Pendidikan Tambusai, 5*(3), 10339–10347. https://doi.org/10.37985/murhum.v5i2.999

Ardini, P. P., & Lestariningrum, A. (2023). *Bermain dan permainan anak usia dini: Sebuah kajian teori dan praktik [Play and Games in Early Childhood: A Theoretical and Practical Review]*. Adjie Media Nusantara.

Arikunto, S. (2018). *Prosedur penelitian: Suatu pendekatan praktik* (Edisi revisi) [Research Procedures: A Practical Approach (Revised Edition)]. Rineka Cipta.

Arsyad, A. (2017). *Media pembelajaran [Instructional Media]*. Rajawali Pers.

Aslan, S., Agrawal, A., Alyuz, N., Chierichetti, R., Durham, L. M., Manuvinakurike, R. & Nachman, L. (2022). Exploring kid space in the wild: A preliminary study of multimodal and immersive collaborative play-based learning experiences. *Educational Technology Research and Development, 70*(1), 205–230. https://doi.org/10.1007/s11423-021-10072-x

Asmawati, S., & Mahabbati, A. (2025). Enhancing early literacy through collaborative digital educational games: A classroom action research with kindergarten children exhibiting ADHD symptoms. *Journal of Innovation and Research in Primary Education, 4*(4), 2346–2355. https://doi.org/10.56916/jirpe.v4i4.2295

Behnamnia, N., Kamsin, A., Ismail, M. A. B., & Hayati, S. A. (2023). A review of using digital game-based learning for preschoolers. *Journal of Computers in Education, 10*(4), 603–636. https://doi.org/10.1007/s40692-022-00240-0

Choiriyah, C., Widiati, D. P., & Emiliana, W. (2023). The role of literacy in increasing children's reading interest in early childhood. *Indonesian Journal of Early Childhood Education Studies, 12*(2), 191–203. https://doi.org/10.23887/ijerr.v7i3.67982

Darmayanti, R., & Farida, F. (2025). Permainan tradisional dakon untuk meningkatkan kemampuan berhitung dasar dan keterampilan sosial siswa kelas 2 SD (SDGs 4 & SDGs 3) [Traditional Dakon Game to Improve Basic Numeracy Skills and Social Skills of Grade 2 Elementary School Students (SDGs 4 & SDGs 3)]. *Jurnal Penelitian Tindakan Kelas, 3*(1), 07–16. https://doi.org/10.61650/jptk.v3i1.761

Ermiyati, E., Rohmadheny, P. S., Rosada, U. D., & Hastuti, D. (2024). Early childhood education teachers' perspectives on play-based learning: A survey in Yogyakarta [Early Childhood Education Teachers' Perspectives on Play-Based Learning: A Survey in Yogyakarta]. *Golden Age: Jurnal Ilmiah Tumbuh Kembang Anak Usia Dini, 9*(2), 291–300. https://doi.org/10.14421/jga.2024.92-10

Fara, F., Wondal, R., & Mahmud, N. (2020). Kajian penerapan permainan bowling berbahan bekas pada kemampuan berhitung permulaan anak [A Study on the Implementation of Recycled Bowling Games on Children's Early Numeracy Skills]. *Cahaya Paud, 2*(2), 383679. https://doi.org/10.33387/cp.v2i1.2036

González-González, C. S., Guzmán-Franco, M. D., & Infante-Moro, A. (2019). *Tangible technologies for childhood education: A systematic review*. *Sustainability, 11*(10), 2910. https://doi.org/10.3390/su11102910

Guo, P. (2023). Approaches to enhance game-based teaching literacy for kindergarten major students. *Pacific International Journal, 6*(4), 120–124. https://doi.org/10.55014/pij.v6i4.489

Hartt, M., Hosseini, H., & Mostafapour, M. (2020). *Game on: Exploring the effectiveness of game-based learning*. *Planning Practice & Research, 35*(5), 589–604. https://doi.org/10.1080/02697459.2020.1778859

Hibana, H., Nayla, M. R., & Nurhayati, K. (2024). Exploring the role of game-based learning in early childhood cognitive development: Perspectives from teachers and parents. *Golden Age: Jurnal Ilmiah Tumbuh Kembang Anak Usia Dini, 9*(4), 733–745. https://doi.org/10.14421/jga.2024.94-12

Hijab, M. H. F., Khattab, S., Al Aswadi, N., Neves, J., Qaraqe, M., Othman, A. & Al-Thani, D. (2024). The what, where, who, why, which, and how of collaborative play involving autistic children in educational context: A contextual inquiry. *Frontiers in Education, 9*, 1273757. https://doi.org/10.3389/feduc.2024.1273757

Hurlock, E. B. (2021). *Psikologi perkembangan: Suatu pendekatan sepanjang rentang kehidupan* (Edisi 5) [Developmental Psychology: A Life-Span Approach (5th Edition)]. Erlangga.

Lamrani, R., & Abdelwahed, E. H. (2020). Game-based learning and gamification to improve skills in early years education. *Computer Science and Information Systems, 17*(1), 339–356. https://doi.org/10.2298/CSIS190511043L

Latifah, I., Suriansyah, A., & Amelia, R. (2025). Playing as a bridge to early childhood literacy: A literature review of best practices in early childhood education. *International Journal of Research in Education, 5*(2), 343–357. https://doi.org/10.26877/eq14mp98

Maureen, I. Y., van der Meij, H., & de Jong, T. (2020). Enhancing storytelling activities to support early (digital) literacy development in early childhood education. *International Journal of Early Childhood, 52*(1), 55–76. https://doi.org/10.1007/s13158-020-00263-7

Melati, D. S., & Maghfirah, N. I. (2025). Penerapan alat permainan edukatif bowling angka untuk meningkatkan kemampuan kognitif anak usia dini kelompok A di RA Al-Barokah Bangsalsari Jember *[Implementation of Educational Number Bowling Games to Improve Cognitive Abilities of Group A Early Childhood Learners at RA Al-Barokah Bangsalsari Jember]*. *Jurnal Al-Fatih, 8*(2), 569–588. https://doi.org/10.61082/alfatih.v8i2.582

Meno, O., Sada, E. Y., & Qondias, D. (2024). Analisis kebutuhan media kartu emosi untuk aspek kemampuan sosial emosional anak usia 5–6 tahun [Needs Analysis of Emotion Card Media for the Social-Emotional Development of Children Aged 5–6 Years]. *Jurnal Citra Pendidikan Anak, 3*(3), 1134–1142. https://doi.org/10.38048/jcpa.v3i3.4664

Moleong, L. J. (2017). *Metodologi penelitian kualitatif [Qualitative Research Methodology]*. Remaja Rosdakarya.

Mulyani, N. (2023). *Dasar-dasar pendidikan anak usia dini [Foundations of Early Childhood Education]*. Kalimedia.

Mulyani, N. (2023). *Pembelajaran anak usia dini berbasis bermain: Konsep, strategi, dan implementasi [Play-Based Learning in Early Childhood Education: Concepts, Strategies, and Implementation]*. Prenadamedia Group.

Musyaddad, K. (2019). Permainan tradisional sebagai model permainan edukatif untuk meningkatkan kemampuan sosial emosional anak usia dini [Traditional Games as an Educational Play Model to Enhance Social-Emotional Skills in Early Childhood]. *Al-Athfaal: Jurnal Ilmiah Pendidikan Anak Usia Dini, 2*(1), 14–24. https://doi.org/10.24042/ajipaud.v2i1.3995

Mutiah, D. (2020). *Psikologi bermain anak usia dini*. Kencana Prenada Media Group.

Mwinsa, G. M., & Dagada, M. (2025). Play-based learning: A pedagogical approach for social skills development in ECE learners in Zambia. *Social Sciences & Humanities Open, 11*, 101396. https://doi.org/10.1016/j.ssaho.2025.101396

Mwariko, S. A., & Kurniati, E. (2023). The role of teachers in promoting play-based learning in STEAM education in early childhood education. *Cakrawala Dini: Jurnal Pendidikan Anak Usia Dini, 15*(2), 203–212. https://doi.org/10.17509/cd.v15i2.74417

Nilsson, M., Ferholt, B., & Lecusay, R. (2018). 'The playing-exploring child': Reconceptualizing the relationship between play and learning in early childhood education. *Contemporary Issues in Early Childhood, 19*(3), 231–245. https://doi.org/10.1177/1463949117710800

Panjaitan, N. A. S., & Al Rasyid, H. (2023). Pengembangan Media Pembelajaran Komik Bahasa Arab Berbasis Canva [Development of Canva-Based Arabic Comic Learning Media]. *Journal Of Education Research, 4*(2), 484–495. https://doi.org/10.37985/jer.v4i2.182

Porter, J. E., Dabkowski, E., Prokopiv, V., Missen, K., Barbagallo, M., & James, M. (2023). *An exploration into early childhood physical literacy programs: A systematic literature review*. Australasian Journal of Early Childhood, 48(1), 34–49. https://doi.org/10.1177/18369391221118698

Putri, D. A., & Wulandari, M. D. (2024). *The Effectiveness of Educational Games in Digital Literacy to Improve Healthy Social Interactions in Elementary Schools*. Proceeding ISETH, 1817–1825. https://proceedings.ums.ac.id/iseth/article/view/5853

Rahimah, R., Mutmainnah, M., Rita, C. M., Adibah, K. T. W., Isdarianti, N. L., & Fauzi, I. (2023). Enhancing Early Childhood Literacy through Reading Corners [Enhancing Early Childhood Literacy through Reading Corners]. *Golden Age, 8*(4), 213–223. https://doi.org/10.14421/jga.2023.84-02

Ramadani, U., & Hikmah, N. (2024). Pengaruh Metode Bermain Terhadap Perkembangan Sosial Anak Usia Dini *[The Effect of Play Methods on Early Childhood Social Development]*. *JUPENJI, 3*(4), 36–45. https://doi.org/10.57218/jupenji.Vol3.Iss4.1331

Rand, M. K., & Morrow, L. M. (2021). The contribution of play experiences in early literacy. *Reading Research Quarterly, 56,* S239–S248. https://doi.org/10.1002/rrq.383

Ribeiro, S., Beça, P., & Aresta, M. (2022). Fostering the development of teachers' digital literacy whilst promoting new pedagogical strategies. *EDULEARN22 Proceedings,* 9606–9612. https://doi.org/10.21125/edulearn.2022.2315

Salimi, M., & Fauziah, M. (2023). Social skills in early childhood and primary schools: A systematic review. *Jurnal Ilmiah Peuradeun, 11*(2), 441–474. https://doi.org/10.26811/peuradeun.v11i2.930

Samhani, S., Ali, M. D., & Hanifah, O. (2025). *Penggunaan Permainan Bowling Dalam Pengenalan Angka [The Use of Bowling Games in Number Recognition]*. KHIRANI, 3(1), 172–185. https://doi.org/10.47861/khirani.v3i1.1579

Saputri, N. A., & Wulandari, H. (2024). *Parental problems in early childhood education in the digital era*. Inovasi Kurikulum, 21(1), 287–302. https://doi.org/10.17509/jik.v21i1.64115

Sari, D. A. M. (2025). The Role Of Traditional Games In Improving Early Childhood Social Skills. *MSJ, 3*(1), 21–29. https://doi.org/10.61942/msj.v3i1.303

Sendil, C. O., & Erden, F. T. (2012). Preschool teachers' strategies to enhance social interaction skills. *Procedia-Social and Behavioral Sciences, 47,* 918–923. https://doi.org/10.1016/j.sbspro.2012.06.757

Snow, C. E., Burns, M. S., & Griffin, P. (2021). *Developing early literacy*. National Early Literacy Panel.

Sugiyono. (2019). *Metode penelitian kuantitatif, kualitatif, dan R&D [Quantitative, Qualitative, and R&D Research Methods]*. Alfabeta.

Sujiono, Y. N. (2021). *Bermain sambil belajar untuk anak usia dini [Learning Through Play for Early Childhood]*. Indeks.

Suryaningsih, S., & Aisyah, E. N. (2024). The Role of Technology in Improving Early Childhood Social Skills. *Education and Sociedad Journal, 1*(2), 53–61. https://doi.org/10.61987/edsojou.v1i2.598

Swasthi, D. Y., Suryawan, I. G., & Putri, A. R. (2024). Analisis Permainan Bowling sebagai Media Stimulasi Aspek Perkembangan Anak Usia Dini *[Analysis of Bowling Games as a Medium for Stimulating Early Childhood Developmental Aspects]. RAJULA, 1*(2), 168–179. https://ejournal.sidyanusa.org/index.php/rajula/article/view/633

Suyadi. (2021). *Teori pembelajaran PAUD dan implementasinya dalam kurikulum [Early Childhood Learning Theories and Their Implementation in the Curriculum]*. Remaja Rosdakarya.

Vygotsky, L. S. (2023). *Mind in society: The development of higher psychological processes*. Harvard University Press.

Wardhani, K. K., Iriyanto, T., & Maningtyas, R. D. T. (2024). Pengembangan Media Permainan Face Poly *[Development of Face Poly Game Media]. Jurnal AUDHI, 7*(1), 81–89. http://dx.doi.org/10.36722/jaudhi.v7i1.3039

Waruwu, M. (2024). Metode penelitian dan pengembangan (R&D) *[Research and Development (R&D) Methods]. Jurnal Ilmiah Profesi Pendidikan, 9*(2), 1220–1230. https://doi.org/10.29303/jipp.v9i2.2141

Widayati, J. R., Safrina, R., & Supriyati, Y. (2021). Alat permainan edukatif *[Educational Play Tools]. Jurnal Obsesi, 5*(1), 654–664. https://doi.org/10.31004/obsesi.v5i1.692

Wohlwend, K. (2023). Serious play for serious times: Recentering play in early literacy classrooms. *The Reading Teacher, 76*(4), 478–486. https://doi.org/10.1002/trtr.2157

Yulia, R., & Eliza, D. (2021). Pengembangan literasi bahasa anak usia dini *[Development of Early Childhood Language Literacy]. Golden Age, 5*(1), 53–60. https://ejournal.unisba.ac.id/index.php/golden_age/article/view/8437