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*Article*

# Impact of Digital Games on Preschool Learning: An Exploratory Study

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**Abstract:** Preschool education plays a significant role in shaping the cognitive, social and emotional development of early childhood learners. The COVID-19 pandemic has led to a shift from traditional classrooms to online learning, which has accelerated the integration of game-based learning (GBL) in preschool settings. This exploratory case study examines the impact of digital games on the learning experiences of preschool children in a Malaysian preschool setting. Using a qualitative case study approach, data were collected through semi-structured interviews, direct observations and document analysis with two children, one teacher and one parent. The results suggest that digital games improve children's digital literacy, motivation and problem-solving skills, especially in numeracy. Children demonstrated increased engagement, concentration and emotional enjoyment during the game-based learning sessions. However, the study also identified several challenges, such as limited access to technology, technical difficulties, and the need for adult supervision. This study offers insights for educators, parents, and policymakers regarding the integration of digital tools in early childhood education. The limitations of this study include the small sample size, limitation to one preschool, and short follow-up period, which may affect the generalisability of the findings. Future studies should consider longitudinal studies with larger and more diverse samples. Despite its limitations, this study highlights the potential of digital games to support and enrich early childhood education in Malaysia, especially during periods of remote learning.

**Keywords**: Digital Games; preschool education; game-based learning; education technology.

## Introduction

In recent years, digital technologies have increasingly been integrated into early childhood education, particularly to support the cognitive, social, and emotional development of preschool children (Liu & Li, 2020). Preschool-aged children, typically between ages 4 and 6, are in a critical developmental phase where they learn best through active engagement and play (Sharifah & Aliza, 2012). Play has been recognized as an essential element of early childhood education, as it enhances children's ability to explore their environment, interact with others, and solve problems creatively (Johnson, Christie, & Wardle, 2010). According to Piaget's Cognitive Development Theory, children at this stage are focused on exploration and sensory experiences to build knowledge, making play an ideal approach to learning (Piaget, 1952).

The outbreak of COVID-19 in early 2020 led to the abrupt closure of schools, including preschools, forcing educators, parents, and children to adapt to online learning environments (Umaira, Zahir, & Adam, 2020). This sudden shift to remote learning posed significant challenges for educators and families, as

preschool education had traditionally emphasized hands-on and interactive learning experiences (Rahim & Karim, 2021). To meet these challenges, educators turned to digital games as a method of game-based learning (GBL), which can engage children in meaningful learning experiences while providing flexibility in an online setting (Radha et al., 2020).

Based on Piaget's theory, this study recognizes that preschool children in the preoperational stage benefit from symbolic play, intuitive reasoning, and interactive experiences. Digital games such as Zapzapmath are appropriate developmental tools that use visual and symbolic learning to engage children and support cognitive development. The purpose of this exploratory case study is to investigate the impact of digital games on preschool learning in the Malaysian context. Specifically, the study aims to identify the benefits of game-based learning, examine its impact on children's engagement and cognitive development, and explore the challenges faced by stakeholders in implementing digital learning tools. By achieving these objectives, this study makes a significant contribution to the emerging field of educational technology in early childhood education, offering practical implications for educators, policy makers, and curriculum designers.

## Literature Review

### 1. Benefits of Digital Games in Preschool Education

Digital games offer several theoretical and pedagogical advantages in early childhood education. They are designed to promote cognitive development, foster social interaction, and enhance emotional regulation (Zhao & Qiu, 2021; Blazenka & Damir, 2011; Ginsburg, 2007). These games provide a playful and interactive environment for learning foundational skills like numeracy, language, and problem-solving (Castillo & Cruz, 2022; Farhana & Hayati, 2014). Asrifan, Hamid, and Syawal (2024), along with Kurent and Avsec (2024), emphasize that digital tools have become integral to early education systems.

Additionally, game-based learning environments often incorporate elements like curiosity, challenge, and fantasy to capture children's interest. This can result in higher intrinsic motivation and deeper engagement with learning materials (Zupan, Glas, & Šubic-Kovač, 2018). Visually rich, well-designed educational games stimulate children's imagination and promote exploratory learning, which can increase enjoyment and overall learning satisfaction (Hooshyar, Yousefi, & Lim, 2020; Lin, Chien, & Hsu, 2019).

### 2. Effects of Digital Games on Preschool Education

Digital games have shown significant effects on cognitive, emotional, and behavioural development on preschool children. For example, results indicate that digital games such as *Dobble* and *Tangram* improved children's auditory memory and cognitive flexibility more than their board game counterparts (Salomatova et al., 2024). Another study reported enhanced attention and memory functions among preschoolers who played digital games (Rubtsova et al., 2024). Park & Kim (2023) further added that game-based activities promote the development of executive functions such as logical reasoning and problem-solving skills. The study by Chen et al. (2024) indicated that digital learning games led to higher enjoyment levels, concentration, and emotional engagement.

Findings from Inoue et al. (2024) suggest that group-based digital play increases motivation and interest in learning among young children. From a behavioural and physical point of view, Güler et al. (2023) emphasized betterment in fine motor coordination and digital fluency, stating that interactive game navigation also helped children's independence and self-care habits. All these findings prove that digital games serve not only as engaging tools but also as effective means to improve multiple domains of early childhood development.

### 3. Challenges in Implementing Digital Games

Despite their advantages, several barriers hinder the widespread use of digital games in early childhood education. Unequal access to technology that was exacerbated during the COVID-19 pandemic remains a persistent problem, especially in low-income or rural households (Radha et al., 2020). In addition, many

children struggle to navigate digital interfaces due to limited literacy or poor motor coordination, often requiring adult supervision.

Teachers and parents have also raised legitimate concerns about excessive screen time, appropriateness of content, and lack of training in integrating digital games into pedagogy (Chen et al., 2012; Rahim & Karim, 2021). Without the appropriate instructional support, digital tools risk becoming a passive activity rather than a structured opportunity for learning. As such, educational games need to be aligned with educational goals and supported by teacher training and digital literacy policies.

4. Gaps in Research

While digital game-based learning is well-documented in primary and secondary education, its role in preschools, particularly in Southeast Asia, remains under-researched. Few studies contextualize digital games within developmental frameworks such as Piaget's theory or examine their use in crisis settings such as the COVID-19 pandemic.

Most importantly, few studies have explored how Malaysian preschool teachers, parents, and children experience and evaluate digital learning tools in authentic classroom settings. As a result, there is a critical gap in understanding the pedagogical, cultural, and infrastructural implications of adopting digital games in Malaysian early childhood education.

This study aims to address these gaps through an in-depth, qualitative case study examining how digital games impact preschool children's engagement, learning outcomes, and cognitive development in a Malaysian preschool. By capturing the experiences of both children and adults, it contributes a more practical and theoretical insight for educational researchers, curriculum developers, and policymakers.

## Methodology

This study uses a qualitative exploratory case study design, suitable for gaining an in-depth understanding of how digital games influences learning in early childhood education. The case study method was chosen to explore real life dynamics and participant experiences in a natural setting.

1. Research Location

The study was conducted at a preschool located in Taman Sea, Petaling, Selangor, Malaysia. This location was chosen for its accessibility to the researcher, which allowed for more efficient planning of interviews and observations. The selected preschool also utilized digital tools in its teaching approach, and both the teacher and the participating children actively engaged in digital game-based learning, making it an appropriate and contextually rich environment for this study.

2. Participants and Sampling

Four participants participated in the study: two preschool children (aged 4–6), one teacher, and one parent. A purposive sampling strategy was used to provide participants with firsthand experience with digital games in early childhood education. Parental consent was obtained from each child, as well as verbal assent from the children in age-appropriate language.

3. Ethical Considerations

This research was carried out under scholarly guidance and in compliance with ethical principles outlined by Palmer and Bolderston (2006), even though it did not receive formal institutional review board ethics approval. These entail voluntariness of participation, consent, privacy, and respect for the rights of the participants. In order to adhere to COVID-19 safety protocols, interviews were held through Google Meet. Any sensitive or inappropriate subject matter was omitted from the interview protocol. The interview guide and emergent themes were critiqued and validated by academicians from Universiti Pendidikan Sultan Idris (UPSI) and Universiti Kebangsaan Malaysia (UKM). This lends credibility to the research tools and analysis.

4. Data Collection

Three methods were used for data collection: semi-structured interviews with teachers and parents to explore their perceptions and experiences; structured questions appropriate for preschoolers; and observation and documentary analysis, including lesson plans, screenshots, and field notes. This multi-source strategy enabled triangulation and a deeper understanding. Interview data served as the primary data set, with observations and documentary sources as supporting sources. Interviews were conducted in Malay and subsequently translated into English. Back-translation techniques were used to ensure accuracy and consistency in translation. The translations were reviewed by bilingual academic colleagues to ensure the intended meaning and clarity of the participants' responses.

5. Data Analysis

All data were manually analyzed using the six-stage thematic analysis method proposed by Braun and Clarke (2006). The analysis process included familiarizing the data, generating initial codes, searching for themes, reviewing themes, defining or naming themes, and writing a final report. Codes and themes were derived inductively from the raw data.

An audit trail was maintained throughout the process. This included original transcripts, code lists, coding notes, and memos to record the development and decisions of themes. Although no software was used, manually organizing the data into tables and matrices ensured consistency and transparency. To increase credibility, data triangulation was used. Observation notes and documents were used to support or challenge themes identified in the interviews. According to Flick (2004), triangulation enables the integration of different perspectives across time, place, and participant roles to achieve a more comprehensive understanding.

6. Conceptual Framework

This study is based on the theories of game-based learning (GBL) and Piaget's theory of cognitive development, as shown in Figure 1. Preschoolers are in a preoperational developmental period, when cognitive growth is supported by active, tangible learning and symbolic play, according to Piaget (1952). These demands are met by digital games like Zapzapmath, which provide self-paced problem-solving, repetition, and captivating visual engagement.

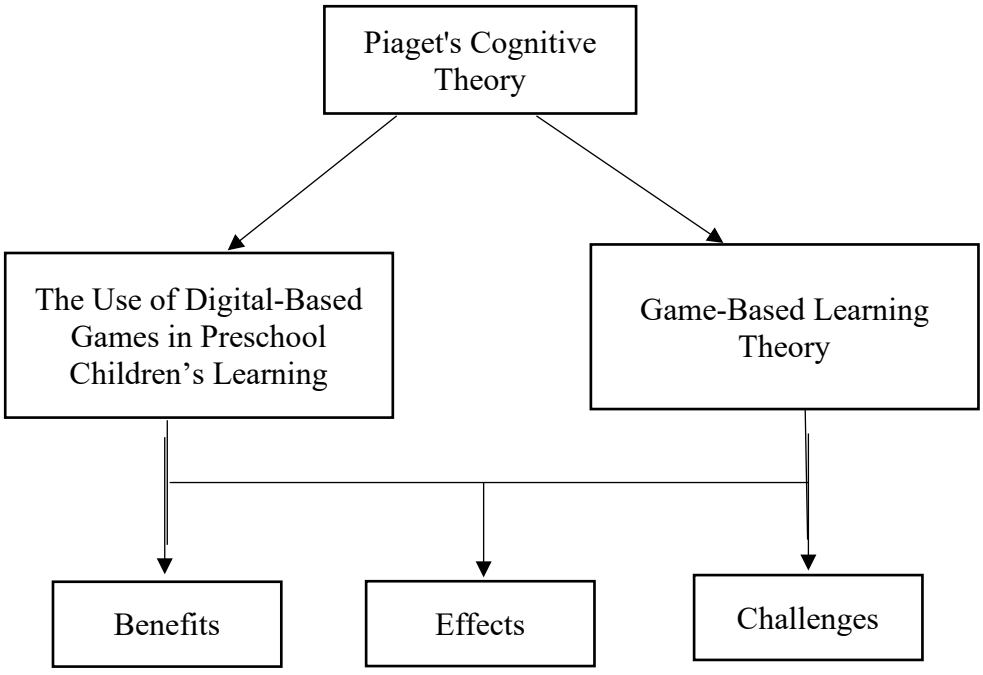


Figure 1. Conceptual framework of the study

At the same time, Prensky (2001) and Gee (2003) established the GBL theory, which highlights how digital games might encourage students' motivation, engagement, and higher-order thinking. These games encourage meaningful learning by combining narrative, challenges, and rewards.

The conceptual framework (see Figure 1) combines these two theoretical perspectives to examine how digital games are used in preschool education. It focuses on three key analytical dimensions which is 1) Benefits of digital-based games in preschool children's learning; 2) Effects of digital-based games in preschool children's learning; and 3) Challenges of digital-based games in preschool children's learning. These dimensions guided the development of the interview protocol, classroom observations, and analysis.

7. Methodological Limitations

Given the qualitative nature of the research, the small sample size is acknowledged as a limitation. The findings reflect the experiences of participants from a single preschool and may not be generalizable. However, the depth and context-rich nature of the data provide meaningful insights that can inform future studies and educational practices.

## The Findings

This section presents the key findings from the study based on the data collected through interviews, observations, and document analysis. The verbatim from the participants have been translated by a translator from Malay to English. This study followed ethical research practices in line with institutional guidelines. Informed consent was obtained from the parents of all participating children. The thematic analysis of the data revealed significant insights into how digital games influence learning, engagement, and the overall educational experience for preschool children.

1. Benefits of Digital-Based Games in Preschool Education

One of the major findings of this study is the positive impact that digital-based games had on children's learning. Participants including two children (K01, K02), one teacher (G01), and one parent (P01)—identified various benefits, such as improved understanding, motivation, enjoyment, and cognitive engagement.

*Cognitive Development and Problem-Solving*

The study revealed that digital games supported children's cognitive growth, especially in areas like numeracy and problem-solving. As they progressed through different game levels, children explored strategies and learned from mistakes, demonstrating better comprehension of mathematical concepts. This supports previous findings by Zupan et al. (2018) and Abdulina (2024), who emphasized the value of digital games in promoting cognitive skills in young learners. A teacher noted:

> *"This game helps them understand numbers faster than traditional teaching methods."* (G01)

One child added:

> *"Yes, I understand when teacher uses games."* (K02)

*Increased Focus and Engagement*

Digital games' interactive design helped sustain children's attention and motivation. During observation, children remained attentive and eager to advance through the tasks. For instance, the parent stated:

> *"They prefer something more interactive… if it's only on paper it's quite difficult to get their focus."* (P01)

These observations align with studies by Farhana & Hayati (2014) and Hooshyar et al. (2020), showing that digital tools enhance engagement in preschool learning environments. This mirrors recent findings by Nor and Syafiqah (2023), who observed that interactive digital environments can significantly boost children's attention and motivation in early learning tasks.

*Emotional Enjoyment and Motivation*

Children also experienced emotional satisfaction, expressing joy and pride as they completed tasks. K02 shared:

> *I feel like playing again… this is fun."* (K02)

One child shared:

> "*They seem happier and engaged when using interactive games compared to paper-based activities."* (P01)

This enjoyment fostered intrinsic motivation to learn, consistent with Ginsburg (2007) and Gronn et al. (2021), who note that playful learning environments enhance emotional development.

Table 1. Benefits of implementing digital-based learning (PdPc) in preschool education

| **Theme** | **Participants** | | | |
|---|---|---|---|---|
| | K01 | K02 | G01 | P01 |
| Improved Understanding | √ | √ | | √ |
| Enjoyment | √ | √ | | |
| Enthusiasm | √ | | | |
| Happiness | | √ | | |
| Greater Focus | | | √ | √ |
| Ease of Problem-Solving | | | √ | √ |

2. Effects of Digital-Based Games in Preschool Education

The second research objective examined how digital games influenced preschool children's cognitive, emotional, and social development. Participants reported noticeable improvements in math comprehension, digital literacy, and learning confidence.

Table 2. Effects of digital-based games in preschool education

| **Theme** | **Participants** | | | |
|---|---|---|---|---|
| | K01 | K02 | G01 | P01 |
| Quicker understanding | √ | √ | | √ |
| Gadget Skills Improvement | √ | √ | | |
| Application to Other Subjects | √ | | | |
| One-on-One Guidance | | √ | | |
| More Responsive Answers | | | √ | √ |

*Conceptual and Mathematical Understanding*

All participants reported that digital games supported quicker and deeper understanding of basic numeracy skills. Children were able to grasp addition concepts faster and retain them more effectively compared to traditional methods. This was particularly evident in the responses of K01 and K02, who expressed confidence and clarity when solving simple equations. P01 echoed this observation too, stating that motivation to complete game levels encouraged faster comprehension.

One child exclaimed:

*"I know this!"* (K01)

Another childs shared:

*"Yes, I know if 2 + 5 equals 7"* (K02)

*"They understand more quickly, especially when they're excited and want to move to the next stage."* (P01)

*Improved Digital Literacy and Gadget Skills*

Children's competence in using digital tools such as tablets and computers also improved. Both children noted that they became more confident with these devices, especially when learning through games. K01 reflected:

*"I think I learned a bit about how to use the computer. I prefer using the iPad for class and games"* (K01)

*"They're getting better at using gadgets. But some will switch to YouTube when the teacher isn't looking."* (G01)

Similarly, the teacher (G01) acknowledged these skills but stressed the importance of supervision, as some children were prone to distraction. This suggests that while digital literacy is strengthened, structured guidance is essential for maintaining learning focus.

*Transfer of Knowledge to Other Subjects*

The final theme was the integration of digital games into various academic subjects. The teacher observed that games provided new ways to reinforce learning, particularly in mathematics:

*"We've used various methods… and we can apply the usage of games to subjects like Mathematics."* (G01)

This supports the potential of game-based learning as a cross-curricular teaching strategy, enhancing engagement and comprehension across learning areas. Digital games demonstrated multiple positive effects on children's learning, including faster grasp of mathematical concepts, improved digital tool handling, and broader application of knowledge. These findings reinforce the value of incorporating game-based strategies into early childhood education, while also highlighting the need for teacher facilitation and structured use.

3. Challenges of Implementing Digital-Based Games in Preschool Education

While the benefits of digital games were apparent, the study also identified several challenges associated with their use in the preschool learning environment. These challenges were experienced by both the children and the adults facilitating the learning process.

*Learning Difficulties and Instructional Gaps*

Some children found digital math activities confusing or harder than traditional methods. Although the games were intended to simplify concepts, not all students responded positively. This suggests that even interactive tools require pedagogical scaffolding to meet diverse learner needs.

> *"Mathematics is hard,"* (K01)

> *"Worksheets are easier."* (K02)

*Game Design and Engagement Limitations*

Both the teacher and parent noted that not all students found the games engaging. G01 observed that while some children enjoyed the game, others grew bored or disengaged without teacher facilitation. P01 commented that some instructions were unclear:

> *"They found it confusing. They weren't sure what to do in the game sometimes."*

These findings mirror Radha et al. (2020) and Chen et al. (2012), whereby they highlighted that technical barriers and poorly designed interfaces are common limitations in educational technology for young learners. This highlights the need for developmentally appropriate game design and intuitive navigation for preschool learners.

*Collaboration between Educators and Developers*

A key challenge identified was the lack of alignment between game design and curriculum goals. The teacher (G01) emphasized the importance of collaborative development between educators and game creators to ensure age-appropriate, pedagogically sound content.

> *"With more collaboration between teachers and game developers, we can better help children in subjects like mathematics."* (G01)

This indicates that successful integration of digital games requires joint effort to design tools that are not only engaging but also educationally effective.

Table 3. Challenges of Implementing Digital-Based Games in Preschool Education

| **Theme** | **Participants** | | | |
|---|---|---|---|---|
| | K01 | K02 | G01 | P01 |
| Difficulty Understanding Mathematics | √ | √ | | |
| Lack of Engagement | | | √ | √ |
| Need for Parent-Teacher Support | | | √ | |
| Game Instructions Are Confusing | | | √ | |

The challenges highlight the importance of thoughtful game design, instructional alignment, and teacher involvement. Addressing these areas can help maximize the benefits of digital-based games while minimizing barriers in preschool education contexts.

## Discussion

This study explored the use of digital-based games in Malaysian preschool education, revealing key benefits, effects, and challenges from the perspectives of children, parents, and educators. The findings confirm that game-based learning (GBL) can support early numeracy development, increase engagement, and improve children's motivation. However, challenges such as usability barriers, content relevance, and the need for teacher support suggest that GBL must be carefully designed and implemented to be effective.

1. Implications for Malaysian Preschools and Ministry of Education Policies

The positive learning outcomes reported particularly increased focus, improved understanding, and enjoyment and indicate that digital games hold potential as a complementary pedagogical tool in Malaysian preschools. This has policy implications. The Ministry of Education (MOE) could consider incorporating digital games into the preschool curriculum, provided there are clear guidelines and training for educators. Ahmad and Zulkifli (2022) recommend targeted professional development as a strategy to ensure successful technology integration in preschool classrooms. Specifically, professional development programs should be designed to equip teachers with skills to integrate digital content meaningfully, not just as entertainment but as structured learning tools aligned with national preschool standards.

Furthermore, to address digital equity, MOE initiatives might include expanding access to educational apps and ensuring schools are equipped with appropriate infrastructure. The findings also underscore the importance of collaboration between game developers and educators, suggesting that MOE could facilitate partnerships to co-develop games that reflect Malaysia's language, culture, and curriculum goals.

2. Theoretical Contributions and Advancement of GBL Understanding

Drawing on Piaget's cognitive theory and game-based learning theory, this study adds to the growing body of evidence that play-based activities, particularly digital games, enhance cognitive development through active engagement and problem-solving. Unlike passive learning, GBL encourages exploration, discovery, and self-directed learning, supporting Piaget's notion of constructivist knowledge building. Moreover, the study extends game-based learning theory by showing that digital games can serve not just as motivational tools but as meaningful cognitive scaffolds. The children's gradual mastery of mathematical concepts while progressing through game levels exemplifies how games can support zone-of-proximal development (ZPD), where learners move from assisted to independent competence. These insights expand the understanding of how GBL supports early childhood cognitive, emotional, and technological readiness particularly in under-researched Southeast Asian contexts like Malaysia.

3. Extending and Challenging Existing Literature

While many studies (e.g., Ginsburg, 2007; Daubert et al., 2018) highlight the benefits of hands-on activities in early learning and express concerns about excessive screen time, the present findings suggest a nuanced perspective. When digital games are purposeful, well-designed, and supervised, they can provide benefits comparable to or even exceeding those of traditional methods, particularly in motivation and engagement. This challenges screen time scepticism that fails to distinguish between passive consumption and interactive, goal-directed play. Moreover, some literature warns of digital distraction or reduced attention spans, yet this study found that interactive games enhanced children's focus, particularly when gameplay aligned with clear educational outcomes. These results support a more balanced interpretation, rather than dismissing screen-based learning, educators should differentiate between types of screen use and focus on educational value and context.

## Conclusion

This study demonstrates that digital-based games can enhance preschool children's learning by improving engagement, digital literacy, and cognitive skills, particularly in numeracy and problem-solving (O'Neill, 2020). The interactive nature of these games supports sustained attention and motivation, echoing prior research on game-based learning benefits (Farhana & Hayati, 2014; Blazenka & Damir, 2011). However, the

study also identified several challenges, including difficulty in grasping mathematical concepts through games, limited access to appropriate technology, and the need for adult supervision issues similarly noted in previous studies (Radha et al., 2020).

From a theoretical perspective, the findings extend Piaget's cognitive development theory by showing how digital play environments can scaffold problem-solving and symbolic reasoning in early childhood. They also reinforce game-based learning (GBL) theories, suggesting that well-designed digital tools can serve as developmentally appropriate pedagogical strategies in preschool settings.

For Malaysian preschools, these findings highlight the importance of digital literacy initiatives and teacher training programs under the Ministry of Education. Incorporating educational games into preschool curricula requires more than access to devices it also involves equipping educators with the skills to guide digital learning effectively and ensuring alignment between digital content and national learning standards.

This study is limited by its small sample size and narrow geographical focus, as it was conducted in a single preschool in Taman Sea, Selangor. Furthermore, the short observation period limits the ability to assess long-term impacts. Future research should include longitudinal studies and larger, more diverse samples across different Malaysian regions to evaluate the sustained effects of digital games on children's learning and development.

To maximize the educational potential of digital games, collaboration between educators, policymakers, and developers is essential. Tailoring digital content to meet preschool learning goals while addressing user experience and access barriers will be key to ensuring equitable and effective use of game-based learning tools in early childhood education.

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***Conflicts of Interest:*** The authors declare no conflict of interest.

**References**

Abdulina, M. (2024). Enhancing the integration of information and communication technologies in preschool education: Pedagogical training for future teachers. *E-Learning and Digital Media, 17*(6), 342–359.

Ahmad, N. H., & Zulkifli, M. N. A. (2022). Game-based learning and engagement among Malaysian preschoolers: A qualitative inquiry. *e-Bangi: Journal of Social Sciences and Humanities, 17*(1), 85–93.

Asrifan, A., Hamid, R. J., & Syawal, S. (2024). Tech-enhanced early learning: Harnessing the power of persuasive educational technologies. In *Persuasive educational technologies* (pp. 67–85). IGI Global.

Blazenka, B., & Damir, D. (2011). Digital learning tools for preschool education. *Computers & Education, 85*, 112–124.

Castillo, A., & Cruz, M. (2022). Innovations in early childhood digital learning: Integrating game-based strategies for cognitive skill development. *Computers & Education, 174*, 104255. https://doi.org/10.1016/j.compedu.2021.104255

Chen, C.-M., Liu, H.-P., & Huang, Y.-N. (2012). Effect of goal-oriented and game-based math learning on math achievement and cognitive load. *Educational Technology & Society, 15*(3), 127–137.

Chen, J., Lee, Y., & Wang, M. (2024). Game-based learning and its impact on early numeracy skills: A mixed-methods study. *Early Education & Development, 35*(2), 128–145. https://doi.org/10.1080/10409289.2023.2034562

Daubert, E. N., Ramani, G. B., & Rubin, K. H. (2018). The development of cognitive and social skills through play: A review of the literature. *Early Childhood Research Quarterly, 45*, 1–13. https://doi.org/10.1016/j.ecresq.2018.02.012

Farhana, L., & Hayati, M. (2014). Game-based learning and its impact on early childhood development. *Educational Sciences: Theory & Practice, 7*, 34–41.

Flick, U. (2004). *Triangulation in qualitative research*. Sage Publications.

Gee, J. P. (2003). *What video games have to teach us about learning and literacy*. Palgrave Macmillan.

Ginsburg, R. (2007). Play and cognitive development in early childhood. *Child Development Research, 9*, 45–60.

Gronn, D., Romeo, S., McNamara, A., & Edwards, L. (2021). Enhancing early childhood education with digital tools: Supporting young learners' digital literacy. *Journal of Early Childhood Research, 19*(1), 50–64. https://doi.org/10.1177/1476718X20985802

Güler, D., Kaya, M., & Demir, A. (2023). Game-based digital interventions in preschool education: Assessing child outcomes. *European Early Childhood Education Research Journal, 31*(4), 450–467. https://doi.org/10.1080/1350293X.2023.2206578

Hooshyar, T., Yousefi, M., & Lim, H. (2020). Data-driven approaches to game player modeling: A systematic literature review. *ACM Computing Surveys, 53*(1), 1–35. https://doi.org/10.1145/3363576

Inoue, M., Takahashi, R., & Yamada, K. (2024). Integrating digital tools in early childhood math education: Teacher perspectives and challenges. *Education and Information Technologies, 29*, 1001–1020. https://doi.org/10.1007/s10639-024-12345-6

Johnson, J. E., Christie, J. F., & Wardle, F. (2010). *Play, development, and early education*. Pearson.

Kurent, B., & Avsec, S. (2024). Synergizing systems thinking and technology-enhanced learning using the flow theory framework. *Preprints*. https://www.preprints.org/manuscript/202409.0174

Lin, C.-H., Chien, S.-C., & Hsu, C.-C. (2019). Effects of digital game-based learning on achievement, flow and overall cognitive load. *Computers & Education, 137*, 99–113. https://doi.org/10.1016/j.compedu.2019.04.016

Liu, S., & Li, H. (2020). Exploring the role of digital game-based learning in early childhood education: Impacts on cognitive development and engagement. *Educational Technology & Society, 23*(4), 110–124. https://doi.org/10.1111/edtec.2020.014

Nor, H. M., & Syafiqah, R. M. (2023). Digital literacy and learning games: A study on teacher readiness in early childhood education. *e-Bangi: Journal of Social Sciences and Humanities, 18*(2), 45–53.

O'Neill, S. (2020). A systematic review of the literature on the impacts of game-based learning in preschool education. *Educational Research Review, 31*, 100368. https://doi.org/10.1016/j.edurev.2020.100368

Palmer, C., & Bolderston, A. (2006). *A concise guide to ethical research in education*. Routledge.

Park, H., & Kim, S. (2023). Preschoolers and screen-based learning: A study on attention span and engagement. *Asian Journal of Child Development, 18*(1), 33–47.

Piaget, J. (1952). *The origins of intelligence in children*. International Universities Press.

Prensky, M. (2001). *Digital game-based learning*. McGraw-Hill.

Radha, R., Mahalakshmi, K., Sathish, V., & Saravanakumar, R. (2020). E-learning during lockdown of COVID-19 pandemic: A global perspective. *International Journal of Control and Automation, 13*(4), 1088–1099.

Rahim, R., & Karim, N. (2021). Game-based learning during the pandemic: Early childhood teachers' perspectives on challenges and opportunities. *International Journal of Educational Technology, 15*(3), 200–215. https://doi.org/10.11591/ijet.150320

Rubtsova, Y., Vasileva, L., & Smirnova, N. (2024). Digital environments and preschoolers' cognitive growth: A cultural-historical approach. *Journal of Digital Childhood Research, 12*(2), 45–58.

Salomatova, E., Petrova, L., & Volkova, T. (2024). The role of educational games in fostering early mathematical thinking. *International Journal of Early Childhood Education, 30*(1), 22–36.

Sharifah, S., & Aliza, A. (2012). Children's cognitive development through play. *Educational Research Review, 12*(3), 201–213.

Umaira, A., Zahir, M., & Adam, K. (2020). Online learning during COVID-19: Challenges and opportunities. *International Journal of Educational Technology, 16*, 50–62.

Zhao, H., & Qiu, X. (2021). Digital game use in preschool education: Evaluating its effectiveness in enhancing children's literacy and numeracy skills. *Journal of Early Childhood Research, 19*(2), 89–101. https://doi.org/10.1177/earlyres.219213

Zupan, B., Glas, M., & Šubic-Kovač, S. (2018). Enhancing preschoolers' early mathematics skills with digital learning games. *International Journal of Game-Based Learning, 8*(4), 18–33. https://doi.org/10.4018/IJGBL.2018100102