

INTEGRATION OF DIGITAL TOOLS IN EARLY CHILDHOOD: FOCUS ON PLAY-BASED LEARNING, ACTIVE LEARNING, AND SOCIAL INTERACTION

Gabriela Durchevska Georgieva

Bureau for Development of Education, Skopje, North Macedonia, gabrieladgeorgieva@bro.gov.mk

Vesna Horvatovikj

Faculty of Pedagogy “St. Kliment Ohridski,” Skopje, North Macedonia, v.horvatovikj@gmail.com

Vesna Torbovska Vasilevska

Bureau for Development of Education, Skopje, North Macedonia, vesnatorbovska@bro.gov.mk

Abstract: This paper explores the pedagogical implications of using digital tools in early childhood, focusing on their effective integration into the learning process. Given the increased exposure of preschool-aged children to technology, the thesis is that successful implementation of digital tools must be guided by key pedagogical principles. The paper focuses on three fundamental principles: play-based learning, active learning, and the promotion of social interaction. Research confirms that, when used purposefully and in alignment with these principles, digital tools can significantly enhance developmental outcomes for children, supporting their cognitive, social, and emotional growth. The analysis includes a review of relevant literature and studies that substantiate the potential of digital tools as a learning aid, rather than a replacement for traditional pedagogical approaches. The research reveals that, while there is awareness of digital tools in early childhood education in the Republic of North Macedonia, their practical application is predominantly focused on passive content consumption (videos) with irregular frequency of use. This results in untapped potential for holistic child development through the key pedagogical principles of play-based learning, active learning, and social interaction. Educators are more cautious about introducing digital tools to younger children but show greater readiness for children aged 4 to 5 and 5 to 6 years. To maximize the benefits of digital tools in early childhood, it is necessary to:

Shift the focus from passive exposure to digital content toward introducing interactive and play-based digital tools that actively develop creativity and problem-solving skills;

Invest in educator training for the effective use of interactive tools and designing digitally supported activities that promote active learning and social interaction;

Provide adequate digital equipment and software in kindergartens to enable more regular and consistent use of digital tools;

Develop national guidelines for the ethical and pedagogically appropriate use of digital tools in early childhood, aligned with international recommendations, emphasizing the quality of interaction rather than mere screen time.

Keywords: digital tools, early childhood, play-based learning, active learning, social interaction.

1. THEORETICAL FRAMEWORK AND PEDAGOGICAL PRINCIPLES FOR INTEGRATING DIGITAL TOOLS IN EARLY CHILDHOOD

Effective integration of digital tools in early childhood requires a clear pedagogical foundation. This paper focuses on three fundamental, interconnected pedagogical principles that should guide the use of technology:

Play-Based Learning: Digital tools should encourage spontaneous, motivating, and exploratory play, transitioning from passive consumption to active, interactive engagement with digital elements.

Active Learning: It is essential for children to actively engage with digital content, rather than merely observing it passively. Tools should serve as a medium for creativity, problem-solving, and independent discovery.

Social Interaction: Digital tools should enrich and support collaboration, communication, and joint learning among peers and with adults, countering concerns that technology may isolate children.

These principles are rooted in two key theories of learning and development. Constructivism (Piaget, 1964) posits that children are active constructors of their own understanding, building knowledge through interaction with their environment, experimentation, and reflection. In this context, digital tools should provide opportunities for active exploration, challenge, and creative expression (Papadopoulou et al., 2021). The socio-cultural theory (Vygotsky, 1978) emphasizes the critical role of social interaction and cultural tools in cognitive development. Learning is primarily a social process, where children construct knowledge through collaboration with more experienced peers and adults within the Zone of Proximal Development. When used purposefully, digital tools become new “cultural tools” that help children think and communicate in the digital world (UNESCO, 2018). This implies promoting social interaction and collaboration, with educators playing a key role in guiding children (NAEYC & Fred Rogers Center, 2012).

Recent research highlights the distinction between passive media consumption and active, interactive use. Well-designed interactive educational applications positively impact cognitive development (Furenes et al., 2021), while excessive exposure to passive media can lead to reduced social interaction and attention issues (Radesky et al., 2014). Digital Game-Based Learning (DGBL), when designed based on pedagogical principles, significantly enhances learning (Lamrani & Abdelwahed, 2020). Studies consistently underscore the crucial role of adults in mediating digital experiences, as active adult engagement significantly increases educational benefits (Barr et al., 2008).

International organizations such as UNESCO (2018, 2023) and the National Association for the Education of Young Children (NAEYC & Fred Rogers Center, 2012) advocate for a balanced and effective approach to technology in early childhood, emphasizing intentional, appropriate, and purposeful use, the critical role of educators, and the development of digital citizenship.

In the context of these global recommendations, this paper examines the current state of early childhood education in the Republic of North Macedonia, exploring educators' attitudes and practices regarding the integration of digital tools, with a focus on play-based learning and social interaction.

2. RESEARCH METHODOLOGY

The research employed a quantitative approach, using an online survey (Google Forms) as the primary data collection tool. The survey was distributed to educators in kindergartens across the Republic of North Macedonia via social media. It was available for completion over a fifteen-day period, with assurances of anonymity and voluntary participation. A total of 100 educators from 16 different municipalities participated, ensuring geographical representativeness. The survey included:

Demographic questions (workplace, age group of children).

Multiple-choice questions (types of digital tools and frequency of use).

Likert-scale questions (perceptions of the ideal age for introducing digital technology and its pedagogical benefits).

The collected quantitative data were analyzed using descriptive statistics, including frequencies and percentages, to identify key trends and perceptions. Results are presented through graphical representations and interpreted in the context of the key pedagogical principles of play-based learning, active learning, and social interaction.

Research Hypotheses

General Hypothesis: The implementation of digital tools in early childhood education in the Republic of North Macedonia is in its early stages and has not yet fully realized the potential for holistic child development through play-based learning, active learning, and socially interactive learning.

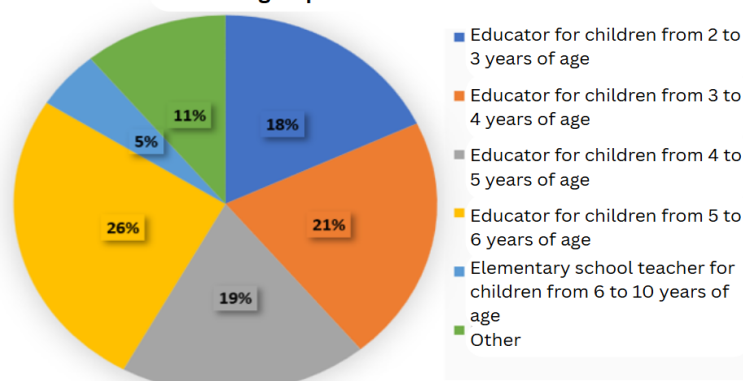
Sub-Hypotheses:

Hypothesis 1: The high dominance of educational videos in the use of digital tools by educators is inversely proportional to the promotion of active learning and play-based learning in children.

Hypothesis 2: There is a positive correlation between the age of children and educators' readiness to introduce digital tools that support active learning and social interaction.

3. INTERPRETATION OF RESULTS

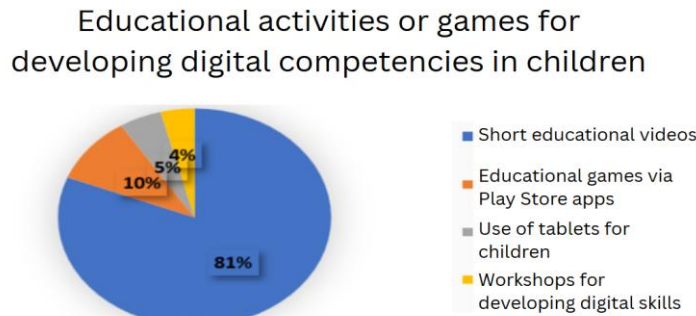
Graph 1: Distribution of Educators by Age Groups of Children They Work With
Distribution of educators by age groups of children



Source: Authors research

The graph indicates a well-balanced sample of educators working with different age groups of children. The largest proportion of respondents (26%) work with the oldest preschool groups (5 to 6 years). Educators working with children aged 3 to 4 years account for 21%, those with 4 to 5 years for 19%, and those with 2 to 3 years for 18%. This provides a comprehensive insight into experiences with digital tools across the entire preschool period, with an emphasis on older groups potentially exposed to more complex digital content.

Graph 2: Distribution of Respondents by Types of Digital Tools Used for Developing Digital Competencies in Children



Source: Authors research

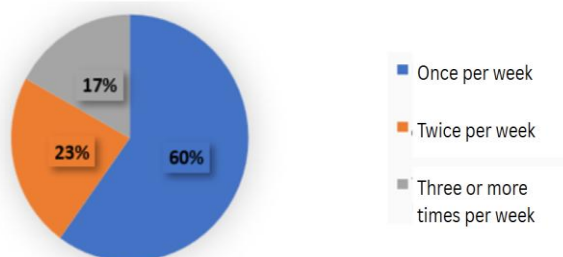
The graph reveals a dominance of short educational videos (81%) as the most commonly used digital tool. This prevalence indicates accessibility and ease of use but also suggests a passive learning approach. Active learning, problem-solving, and creativity are limited when children are merely viewers. Play-based learning and social interaction are also minimally promoted through passive video watching.

In contrast, educational games via Play store applications (10%), the use of children's tablets (5%), and workshops for developing digital skills (4%) are significantly less utilized. These tools have the greatest potential to promote play-based learning (through interactive games), active learning (through manipulation and task-solving), and social interaction (through collaborative projects and discussions). The low use of these interactive tools indicates missed opportunities for developing digital skills and cognitive processes. Based on these data, Hypothesis 1 is confirmed: The high dominance of educational videos in the use of digital tools by educators is inversely proportional to the promotion of active learning and play-based learning in children.

The overall picture obtained from the analysis of used tools unequivocally confirms the general hypothesis: The implementation of digital tools in early childhood in the Republic of North Macedonia is in its early stages and far from fully utilizing the potential for holistic child development through play-based learning, active learning, and socially interactive learning.

Graph 3: Distribution of Respondents by Weekly Frequency of Digital Technology Use in Educational Activities

Application of digital technologies in educational activities with children (Weekly)



Source: Authors research

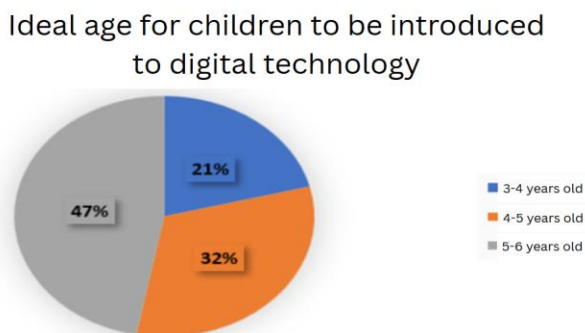
The graph indicates that 60% of educators use digital technologies only once a week. 23% use them twice a week, and only 17% use them three or more times a week. This suggests infrequent and inconsistent use of digital tools in preschools in North Macedonia. This low frequency limits the potential for:

Play-Based and Active Learning: There are insufficient opportunities for spontaneous interaction and exploration with digital tools.

Social Interaction: Infrequent use reduces opportunities for collaborative activities and cooperation through technology.

This confirms the general hypothesis that digital tools are not sufficiently integrated to maximize developmental benefits for children.

Graph 4: Distribution of Respondents by Perceived Ideal Age for Introducing Digital Technology in Educational Activities



Source: Authors research

Nearly half of the respondents (47%) believe the ideal age for introducing digital technology is 5–6 years. A significant portion (32%) considers 4–5 years appropriate, while the smallest percentage (21%) prefers introduction at 3–4 years. This perception likely stems from the cognitive and motor maturity of older children, their school readiness, and their capacity for structured and symbolic play. Introducing digital tools at this age can more easily facilitate group activities and collaboration, enhancing social interaction and active learning. Caution with younger groups may arise from concerns about developmental needs and limitations in active learning without constant supervision.

This result partially confirms Hypothesis 2: There is a positive correlation between the age of children and educators' readiness to introduce digital tools that support active learning and social interaction. Educators feel more prepared to introduce interactive digital tools with older children, where they expect greater cognitive maturity and opportunities for collaboration.

4. CONCLUSIONS

The research reveals that, while there is awareness of digital tools in early childhood education in the Republic of North Macedonia, their practical application is predominantly focused on passive content consumption (videos) with irregular frequency of use. This results in untapped potential for holistic child development through the key pedagogical principles of play-based learning, active learning, and social interaction. Educators are more cautious about introducing digital tools to younger children but show greater readiness for children aged 4 to 5 and 5 to 6 years. To maximize the benefits of digital tools in early childhood, it is necessary to:

Shift the focus from passive exposure to digital content toward introducing interactive and play-based digital tools that actively develop creativity and problem-solving skills.

Invest in educator training for the effective use of interactive tools and designing digitally supported activities that promote active learning and social interaction.

Provide adequate digital equipment and software in kindergartens to enable more regular and consistent use of digital tools.

Develop national guidelines for the ethical and pedagogically appropriate use of digital tools in early childhood, aligned with international recommendations, emphasizing the quality of interaction rather than mere screen time.

With a systematic approach, digital tools can become a powerful catalyst for the holistic development of preschool children, supporting their cognitive, social, and emotional growth.

REFERENCES

- Barr, R., Shira, N., & Radesky, J. (2008). *The effects of interactive media on early child development*. Zero to Three. [URL]
- Lamrani, A., & Abdelwahed, E. H. (2020). Digital Game-Based Learning: A systematic review of the literature. *International Journal of Emerging Technologies in Learning (IJET)*, 15(18), 164–180.
- Learnovate Centre. (2024). *Digital Game-Based Learning (DGBL)*. <https://learnovatecentre.org/insights/digital-game-based-learning-dgbl/>
- Lipsey, M. W., Puzio, K., & Schaeffer, D. (2022). The effects of educational apps on preschoolers' cognitive development: A systematic review. *Early Childhood Education Journal*, 49(6), 1017–1030.
- Madigan, S., Browne, D., & Racine, N. (2024). Screen time and young children's socioemotional development: A systematic review and meta-analysis. *JAMA Pediatrics*, 178(1), 60–68.
- Marsh, J., Brooks, G., & Torgerson, C. (2005). *The effects of digital technologies on young children's literacy development: A review of the literature*. National Literacy Trust.
- NAEYC & Fred Rogers Center. (2012). *Technology and interactive media as tools in early childhood programs serving children from birth through age 8*. Joint Position Statement.
- Papadopoulou, E., Koutromanos, G., & Daskolia, M. (2021). Digital tools in early childhood education: A systematic review of the literature. *Education and Information Technologies*, 26(1), 77–101.
- Piaget, J. (1964). *Six psychological studies*. Vintage Books.
- Radesky, J. S., Schumacher, J., & Zuckerman, B. (2014). Mobile and interactive media use by young children: The good, the bad, and the unknown. *Pediatrics*, 133(5), 1060–1064.
- UNESCO. (2018). *A guide to using ICTs in early childhood education*.
- UNESCO. (2023). *Guidance on generative AI in education and research*.
- Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Harvard University Press.