

THE IMPORTANCE OF EARLY DIGITAL LITERACY OF PRESCHOOL CHILDREN THROUGH THE INTEGRATION OF THE STEAM APPROACH

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Abstract: This paper explores the integration of digital literacy into preschool education through the STEAM approach, focusing on practical examples and the challenges faced by educators and parents. It examines the implementation of digital education programs in preschool settings, emphasizing the importance of interactive and creative methods to develop digital skills in young children. A key example from Leskovac illustrates how digital literacy can be effectively introduced through play in a preparatory preschool group, showing the potential of STEAM to enhance early childhood development. The paper highlights the significance of teacher training and interdisciplinary approaches to successfully incorporate digital literacy into preschool curricula. The conclusion stresses the importance of preparing children for the digital world by fostering early digital competencies and setting a foundation for their future learning.

Keywords: STEAM, preschool education, early childhood development, digital skills, interactive learning

INTRODUCTION

Modern educational systems are subject to continuous changes and improvements to meet the challenges and demands of contemporary society. One of the most innovative approaches in education that is gaining increasing attention is STEAM (Science, Technology, Engineering, Mathematics + Arts) or STREAM (Science, Technology, Reading, Engineering, Mathematics + Arts). The introduction of STEAM into preschool education represents a significant step towards developing critical thinking, creativity, and problem-solving skills in young learners.

The goal of this literature review is to examine the opportunities and challenges of digital literacy in preschool children through examples of good practice and the integration of STEAM principles. Special attention is given to the importance of early digital skills development and strategies parents and educators can apply to prepare children for the challenges of the digital age.

The analysis of challenges in digital literacy highlights issues such as internet security, screen time control, and access to quality digital content. This paper discusses strategies to overcome these challenges, including educational programs for parents and educators. Approaches to digital literacy in preschool institutions consider pedagogical methods and strategies that these institutions can implement, including the use of specialized Web 2.0 tools and digital didactic games adapted to the preschool age.

STEAM EDUCATION AND DIGITAL LITERACY FOR PRESCHOOL CHILDREN

Digital literacy, as defined by UNESCO (2018), encompasses the ability to use digital tools effectively, critically, and safely. In the context of preschool education, this definition extends to age-appropriate interaction with digital technologies for cognitive and socio-emotional development.

The use of STEAM technology in early childhood education offers a unique opportunity to enhance the formation of lexical skills in preschool children. By incorporating interactive and engaging digital tools, educators can create a dynamic learning environment that stimulates language acquisition and vocabulary growth (Yunusova, 2024).

Digital literacy encompasses the capacity to proficiently and critically access, assess, and produce information via various digital tools and technologies. It goes beyond simply knowing how to use devices and software; it encompasses the skills needed to engage with digital content, understand its implications, and use technology responsibly. In the context of early childhood education, digital literacy includes foundational skills such as using digital tools for communication, problem-solving, and creativity. If digital literacy is fostered from a young age, children can develop the skills necessary to thrive in an increasingly digital world.

STREAM education, which encompasses Science, Technology, Reading and Writing, Engineering, Arts, and Mathematics, represents an extension of traditional STEM education by incorporating arts as a key element. This extension enables a holistic approach to education, combining creative and analytical skills. In support of this, digital literacy becomes essential, particularly for preschool children who are already exposed to digital technologies in their everyday lives.

Collaborative STEAM projects promote communication skills and social interaction among preschoolers. Working together on tasks that require verbal exchanges, explanations, and discussions can support the development of vo-

cabulary, language fluency, and interpersonal skills in young learners (Yunusova, 2024).

Recent research indicates that moderate use of digital technology can positively affect children's development, while negative consequences can result from excessive use or, conversely, from no contact with digital technologies at all (UNICEF, 2019).

The STEAM approach integrates disciplines to create engaging educational experiences, such as LEGO construction, robotics, and mathematical development, tailored to preschoolers' cognitive abilities (Kyyakbayeva et al., 2024).

One of the key ways STEAM education can be linked to digital literacy is through the integration of technology into play and learning. Using digital tools and resources can significantly enrich educational activities. For example, children can use tablet computers to draw and design simple projects, which fosters their creativity (arts) while simultaneously teaching them basic digital skills (technology).

STEAM includes the Arts with other STEM domains, recognizing that creativity and the arts are key elements of learning and pivotal to innovation. This integration offers children opportunities for individual expression and diverse communication, making STEM experiences more socially and culturally relevant (Johnston, Kervin, & Wyeth, 2022).

STEAM education promotes the development of critical thinking and problem-solving skills, which are crucial for digital literacy. Through activities that involve exploration and experimentation, children learn how to approach problems systematically, using technology to gather data, analyze it, and present results. For instance, children can use digital microscopes to explore biological samples, combining science, technology, and arts through the visualization and interpretation of data.

STEM and STEAM approaches in early childhood support inquiry and problem-solving, offering children opportunities to explore the world through systematic, authentic investigations that integrate design thinking and scientific processes (Johnston, Kervin, & Wyeth, 2022).

THE IMPORTANCE OF DIGITAL LITERACY IN PRESCHOOL AGE

Digital literacy prepares children for future educational challenges by promoting logical and systematic thinking and enhancing their competitiveness in the modern world (Purnamasari et al., 2020).

Digital literacy encompasses the ability to understand, use, and create digital content. In preschool, this means developing basic skills such as using

digital devices, navigating simple apps, and fostering critical thinking in the context of digital media. Early exposure to technology can significantly influence later educational outcomes and prepare children for the modern digital world.

Digital literacy in the educational context plays a crucial role in developing a child's cognitive abilities by stimulating curiosity and creativity. It includes the ability to use digital tools to find, evaluate, utilize, create, and communicate content effectively (Hafizzaturroyani et al., 2024).

Digital technologies in learning allow children to satisfy their needs for exploration. Digital tools are employed in direct work with children to deepen their experiences, encourage richer play and interaction with others, stimulate their imagination, and contribute to the development of various forms of expression. In an environment where ICT is widely used, children are additionally motivated to collaborate in play, experiment with and combine different tools, exchange ideas, and enjoy joint activities, while making personal contributions.

The use of digital technology can also be seen as a social activity and a way to support children's learning. The equipment, located in a specific area and available to children throughout the day, allows them to search for answers together with their peers, find various solutions, and gain ideas for further research or project development.

Author Bolstad (2004) believes that the literature suggests at least three reasons why information and communication technologies (ICT) are important in the education of preschool children. First, ICT already affects the people and the environment in which children learn. Second, these technologies offer new opportunities to enhance many aspects of early childhood practice. Third, there is support and interest from the entire education sector for the development and integration of ICT in education policy. When used appropriately, ICT can be a valuable tool to support the learning and development of preschool children (Bolstad, 2004).

CHALLENGES AND LIMITATIONS IN THE USE OF DIGITAL MEDIA IN PRESCHOOL EDUCATION

The integration of digital media in preschool education, while promising, faces significant challenges and limitations, particularly in the context of implementing STEM (Science, Technology, Engineering, and Mathematics). One primary challenge is to ensure that digital tools are developmentally appropriate for young learners, as excessive screen time or poorly designed applications can hinder rather than help cognitive and social development.

Although the process of STEM education is dynamic, preschool educators find it difficult to innovate ways to integrate STEAM (Science, Technology, Engineering, Arts, and Mathematics) content and pedagogical methods into school-based curricula. The role of preschool educators is evolving from delivering knowledge through a teacher-centered approach to nurturing STEM-related learning in children. However, many kindergarten teachers lack sufficient professional training in STEAM teaching methods, resulting in weak teaching skills and poor understanding of STEAM education concepts (Leung, 2023).

STEAM learning activities often face challenges such as the lack of teacher training and appropriate guidebooks. Teachers must transition from teacher-centered to child-centered methodologies, which demand the integration of STEAM components with real-world projects suitable for children's developmental stages (Hafizzaturroyani et al., 2024).

Further research is needed to understand the professional learning needs of early childhood educators in implementing STEAM learning, as well as to refine assessment techniques that can accurately capture the development of early childhood literacy through STEAM (Karta & Rasmini, 2022).

Digital technologies can assist in overcoming various deficits and obstacles that parents alone cannot address to provide optimal developmental conditions for their children. It has become common for children to use the Internet, leading parents to try to increase opportunities for their children's advancement by using digital resources, while simultaneously considering the associated risks (Livingstone et al., 2017).

The STEAM learning model, supported by parental involvement, has been found to increase children's creativity and motivation, promoting an environment that encourages collaboration, critical thinking, and problem-solving (Karta & Rasmini, 2022).

Preschool children are particularly vulnerable to online dangers, including exposure to inappropriate content. Therefore, it is crucial for parents and educators to be well-informed and trained to protect children and guide them toward safe internet use (Livingstone et al., 2017).

ACCESS TO QUALITY DIGITAL CONTENT

The integration of STEAM (Science, Technology, Engineering, Arts, and Mathematics) education in preschools heavily relies on access to quality digital content, which can significantly enhance learning experiences and outcomes. High-quality digital content provides interactive and engaging ways for young learners to explore STEAM concepts, fostering creativity, critical thinking, and problem-solving skills.

Project-based learning within the STEAM model has been shown to effectively increase children's learning activities and outcomes, as it fosters involvement in multiple scientific disciplines and encourages the exploration of problems from various perspectives (Karta & Rasmini, 2022).

When selecting digital content for preschoolers, it is essential to consider its educational value and age-appropriateness. The content should support the specific developmental needs of children, offering relevant and appropriate information in a linguistically and cognitively comprehensible way. Additionally, the content must be interactive and engaging, encouraging active participation and exploration, while also ensuring the safety and quality of the information children consume.

Educators must be equipped with the necessary training and support to effectively integrate digital tools into their STEAM curricula. Bridging the gap in access to quality digital content is essential for maximizing the benefits of STEAM education and ensuring all children have the opportunity to develop essential skills for the future.

STRATEGIES FOR OVERCOMING CHALLENGES

Strategies for overcoming challenges in integrating digital media into preschool education are reflected in the development of educational programs, seminars, forums, and workshops that empower and educate parents and educators. These programs should cover a wide range of topics, starting with Internet security. Through these initiatives, parents and educators can learn how to protect children from online threats, recognize potential dangers, and take appropriate protective measures.

In addition, educational programs should encourage the selection of quality digital content that is adapted to the age and developmental needs of children. Through programs like these, adults can become more competent in guiding children through the digital world, providing them with a safe and stimulating environment for learning and exploration. This is not only a matter of technological literacy but also of responsible parenting and a pedagogical approach that will allow children to make the most of the advantages of the digital era with minimal risks and negative impacts.

One significant challenge is the need for developmentally appropriate, engaging content that can hold the attention of preschoolers while introducing complex concepts. To address this, educators can employ hands-on, interactive activities that blend digital tools with physical manipulatives, making abstract ideas more tangible. Additionally, providing teachers with robust professional

development opportunities is crucial, ensuring they are well-equipped to incorporate STEAM principles effectively into their classrooms.

Research indicates that early childhood educators often lack confidence and skills in STEM domains, impacting curriculum implementation. Professional development is essential to empower educators and enhance their ability to integrate STEAM approaches effectively (Johnston, Kervin, & Wyeth, 2022).

Digital tools, such as educational software and didactic games, can enrich existing learning resources. The virtual world of computer games in which preschool children grow up is often perceived as the opposite of the traditional world of growing up through play (Marsh, 2010). However, computer games as new media have become a desirable tool in the learning process of preschool children.

Web 2.0 tools are a group of social programming tools in which users create content themselves, support collaborative learning, facilitate communication, collaboration, and evaluation, and can be used as a supplement to classical teaching and all forms of extracurricular activities (ZUOV, 2014).

Web 2.0 tools that educators can use in their daily work include:

- **Social networks as an information panel for educators:** Google, Gmail, Facebook, Instagram.
- **Tools for collaboration and sharing:** Viber, YouTube, Symbaloo, Zoom, Google Classroom, Google Docs, Pinterest, Padlet, Lino-it, WordPress, Blogger.
- **Tools for presentations, creating and editing photos, video, and audio content:** Animoto, Prezi, CapCut, PowerPoint.
- **Tools for creating digital didactic games:** Jigsaw Planet, LearningApps, WordWall, Story Bird, and Story Jumper (Krstić Radojković, 2023).

Digital technologies, such as computers and tablets, complement traditional tools in children's play, allowing for a combination of imaginary and non-digital technologies that help develop knowledge and skills about digital concepts (Johnston, Kervin, & Wyeth, 2022).

EARLY DIGITAL LITERACY OF PRESCHOOL CHILDREN THROUGH THE STEAM APPROACH – AN EXAMPLE FROM PRACTICE

The project *Computer and I*, implemented in the preparatory preschool group at PU Vukica Mitrović in Leskovac, aimed to introduce digital technologies to children at an early age. The project successfully integrated STEAM principles through interactive activities that enabled children to explore science, technol-

ogy, reading and writing, engineering, art, and mathematics, thereby developing digital skills and creativity.

The project began by examining how children use computers and other digital devices, which served as a starting point for further activities. Through the creation of panels, interactive presentations, and quizzes, children explored the history of communication, from message transmission via *messengers* to modern technologies. Learning was supported by collaboration with the computer science teacher and parents, who brought old devices such as gramophones, typewriters, and tape recorders, allowing the children to compare old and new technologies.

The practical part of the activities included working on computers, where the children, with the help of school-aged peers, learned to draw in Paint, use Google, write in Word, and print their work. The children acquired digital skills engagingly and interactively. Although they initially wanted to play games, they were encouraged to create educational games using Web 2.0 tools. Through the WordWall program, they learned to create digital didactic games, add images, and change templates. Using the LearningApps tool, they created a dictionary, and with the help of JigSawPlanet, they made puzzles with their pictures and shared them with their parents via a Viber group. These activities allowed them to have fun and learn, even when they were at home.

They regularly visited the IT classroom where, through play, they learned about spatial relations, shapes, occupations, traffic, animals, and nature. By setting up an "office" within the kindergarten, the children applied their acquired knowledge through various roles and simulations of real professions. With the support of older school-aged children, they mastered PowerPoint and prepared a presentation for parents for the end of the school year.

This project is an example of good practice in integrating digital technologies into early education, encouraging creativity, exploration, peer learning, and collaboration among children, thus exemplifying the successful implementation of STEAM principles.

CONCLUSION

Interdisciplinary projects within the STEAM framework can provide children with the opportunity to develop digital skills in the context of solving real problems. In the modern educational context, where technological innovations dictate the dynamics of learning, research on the importance of early digital literacy in preschool opens new avenues for exploring how digital literacy can be integrated into curricula.

Early acquisition of digital skills enables children to develop the necessary competencies that will benefit them in the future. Through creative and interactive approaches, preschools can significantly contribute to children's digital literacy, ensuring they are ready for the challenges and opportunities of the digital age that the STEAM framework provides.

Interdisciplinary projects based on the STEAM approach offer children the opportunity to develop essential digital skills through play and exploration. Projects such as *Computer and I* demonstrate that the use of digital tools in education can significantly contribute to the development of creativity, collaboration, and critical thinking in children, enabling them to face future educational challenges with greater ease.

These experiences helped them approach new learning challenges more easily and with greater confidence. Becoming familiar with programs such as Paint, Word, Google, YouTube, Google Maps, WordWall, LearningApps, JigSawPlanet, and PowerPoint enabled them to actively participate in the educational process and master school material interestingly and interactively. They also showed exceptionally advanced digital competencies in Digital World in the first grade.

Through interactive methods and age-appropriate content, educators can shape positive learning experiences that motivate children for further development. It is essential to continue research on the significance of digital literacy in early childhood to ensure equal opportunities for all children in the dynamic world of the future.

Educators should prioritize structured STEAM activities that combine digital tools with hands-on learning to foster creativity, critical thinking, and problem-solving skills in preschool children. Professional development programs are essential to equip teachers with the necessary skills for effective implementation. Parents should be involved in the digital education process through workshops and collaborative activities to create a consistent learning environment at home and in preschool settings. Community initiatives can bridge gaps in digital literacy resources and foster collective engagement. Future studies should focus on the longitudinal impacts of early digital literacy interventions, particularly how STEAM methodologies influence children's academic and socio-emotional development in later stages of education.

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