Strengthening Literacy, Numeracy, and Digital Skills

Adaliz Barroso

Department of Educational Leadership, Lamar University

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Dr. Kristi Meeuwse

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Introduction

In today's rapidly evolving digital landscape, the lack of technology integration in preschool education presents a significant problem that can hinder children's development and preparedness for future learning environments. As young learners engage with technology daily at home, preschools that fail to incorporate digital tools may risk leaving children at a disadvantage. iPads have become very popular among young children and are increasingly seen as a vital educational tool. It is common to go to a store and see quite a few children with iPads. Due to the increase in technology amongst children many campuses are now placing a stronger focus on technology integration. For example, at HGA, children as young as 3-4 years old start using iPads to reinforce math and literacy skills. As a result, many students in these programs move on to Pre-K4 already reading, recognizing letters and sounds, and even solving simple equations. However, despite this growing trend, iPads are not yet common in all preschool settings. In my campus, for example, Pre-K3 classrooms currently do not have access to iPads, which creates a digital divide at the earliest stages of education. As a preschool teacher, I believe implementing iPads in Pre-K 3 can bring numerous benefits like, enhancing student engagement, promoting foundational digital skills, and improving academic development in key areas such as literacy and numeracy.

I am especially interested in this topic because I see and hear how kindergarten teachers often struggle with students' lack of digital literacy skills. Many young students enter kindergarten unprepared to navigate the digital tools that are now common in modern classrooms. I believe that starting technology integration earlier, through the use of iPads in Pre-K3, could greatly benefit not only the students but also aid teachers by reducing the need for instruction in basic technology use. Early exposure to iPads can build student confidence, foster

independence, and better prepare them for the academic and technological demands of future schooling.

This literature review explores recent research on iPad use in early learning settings, particularly for 3- and 4-year-olds. Three major themes will be discussed throughout this literature review: the development of digital skills and technological fluency, enhancement of early literacy, and improvement of early numeracy. This literature review aligns with the fundamental research question: *In what ways does the integration of iPads in preschool classrooms of 3- and 4-year-olds influence the students' academic development?*

Literature Review

Development of Digital Skills and Technological Fluency

In many school districts, including my own, the integration of technology within early education is currently limited. Recognizing the importance of developing digital fluency from an early age is key. Digital fluency involves the ability to use technology creatively, critically, and responsibly. Introducing technology to pre-kindergarten students is crucial for fostering digital literacy. As Lee (2009) notes, "The ability to use a mouse is a prerequisite skill for computer activity, regardless of age." Moreover, Mashyhura (2022) highlights that "the digital literacy school environment impacts the learning process significantly." It is essential for our students to develop digital literacy so they are kindergarten-ready and can avoid frustration or difficulties due to unfamiliarity with technology. Early exposure to technology equips young learners with the foundational skills necessary for their educational development.

Additionally, as Riyanti et al. (2023) assert, "Utilizing learning technologies and applications, students can enhance their digital abilities, gain a more dynamic and enjoyable understanding of topics and principles, and prepare for a future that is increasingly dependent on technology." These skills not only support students in their academic journey but also prepare them for future success in the workforce.The development of digital skills and technological fluency among preschoolers is essential for their future academic and personal success (Masyhura & Ramadan, 2021). Digital fluency involves the ability to use technology creatively, critically, and responsibly. Pangrazio and Sefton-Green (2021) emphasize that digital literacy extends beyond basic skills, encompassing critical understanding of digital rights and responsibilities as part of becoming an informed digital citizen.

Ease of Use and Early Interaction. Research has found that touch-screen devices like iPads are naturally intuitive for young children to use (Lee, 2009; Couse & Chen, 2010). Preschoolers quickly learn to tap, swipe, and navigate apps with minimal adult intervention but in order to be effective it must be intentional. Papadakis et al. (2017) emphasized that well-designed educational apps provide children with age-appropriate challenges and rewards, reinforcing digital engagement and skills.

Foundations of Digital Literacy. Exposure to digital tools at an early age lays the groundwork for digital literacy (Riyanti et al., 2023). Digital literacy involves recognizing app icons, navigating menus, understanding the symbolic language of technology, and respecting online rights and responsibilities (Pangrazio & Sefton-Green, 2021). Programs that integrate iPads intentionally help students develop these skills, reducing the digital divide that can hinder later academic success (Abdullah et al., 2017).

Building Confidence and Independence with Technology. Students who frequently use tablets demonstrate higher levels of self-regulation, persistence, and problem-solving abilities during digital activities (McNicholl, Desmond, & Gallagher, 2023). Developing these habits early fosters independence and promotes the confident use of digital tools. As Riyanti et al. (2023) assert, "Utilizing learning technologies and applications, students can enhance their digital abilities, gain a more dynamic and enjoyable understanding of topics and principles, and prepare for a future that is increasingly dependent on technology." Children who have access to technology in preschool are better equipped for the digital expectations of kindergarten and beyond.

Enhancement of Early Literacy

The use of iPads in Pre-K3 classrooms has shown significant potential in enhancing early literacy skills. A growing body of research supports the integration of digital tools in early childhood classrooms, indicating that these tools can foster literacy development by promoting phonemic awareness, vocabulary acquisition, and comprehension. Pre-kindergarten students can benefit from using technology as a complement to traditional hands-on activities, rather than as a substitute. For instance, a study titled "Using Tablets in a Prekindergarten Classroom to Foster Phonological Awareness" examined two groups of students: one engaged in traditional learning methods and the other using tablets. The research aimed to assess any differences in phonological awareness between the two groups. At the conclusion of the study, the author observed no significant differences in overall phonological awareness between the two groups.

However, it is noteworthy that the traditional group initially demonstrated higher skill levels compared to the tablet group. The study revealed that the use of tablets was effective in

closing this initial gap, as evidenced by the increase in phonological awareness among the tablet group (Shifflet et al., 2020). This suggests that technology, when implemented thoughtfully, can bridge educational gaps and enhance learning outcomes. Clearly, technology should be utilized in conjunction with traditional methods, particularly for students who are struggling. Research supports this approach, demonstrating that "technology is more effective than traditional printed texts in training phonological skills and developing phonological awareness, and in the acquisition of reading and writing in preschoolers, especially those who have difficulties learning to read" (Raposo-Rivas et al., 2024)

Alphabet Knowledge and Phonemic Awareness. iPad applications targeting phonemic awareness and alphabet knowledge have demonstrated measurable benefits. Shifflet, Mattoon, and Bates (2020) found that using tablets for phonological awareness activities led to improvements in letter recognition and the ability to produce corresponding sounds. Interactive apps allow children to hear letter sounds and associate them with written symbols, reinforcing these skills through engaging repetition. Additionally, Altindag Kumas, Dodur, and Yuzbasioglu (2021) highlighted that name writing skills in preschool children are strongly correlated with early print knowledge, alphabet knowledge, and phonological awareness, further emphasizing the importance of early literacy foundations supported by technology.

Vocabulary and Comprehension through E-books. Digital storybooks available on iPads enhance vocabulary acquisition and reading comprehension. Studies have shown that multimedia e-books, especially those used on tablets, provide scaffolded learning by combining visual, audio, and interactive features to support children's understanding of new vocabulary and concepts (McNicholl et al., 2023). Raposo-Rivas et al. (2024) highlight that technology-enhanced phonological programs support vocabulary growth by integrating visual

and auditory cues. The multimedia features of e-books, such as highlighted text and animated illustrations, help young learners understand narrative structures and new words more effectively than traditional books (Altindag Kumas et al., 2021; Raposo-Rivas et al., 2024).

Motivation and Engagement in Reading. The gamified elements present in many literacy apps contribute to higher motivation and sustained engagement among preschoolers. Herawati, Widajati, and Sartinah (2022) reported that the use of assistive reading technologies like text-to-speech tools increases not only reading performance but also enjoyment, especially for students with attention challenges. Increased enthusiasm for reading tasks ultimately leads to more practice and stronger early literacy outcomes.

Improvement of Early Numeracy

Math readiness is another key area strengthened by intentional iPad use in Pre-K3 classrooms.Digital tools offer new ways for young learners to interact with foundational math concepts in ways that are engaging, developmentally appropriate, and highly personalized. With careful selection of apps and guided usage, technology can support early mathematical thinking by introducing critical skills such as counting, number recognition, sequencing, and pattern identification.

Counting and Number Recognition. Tablet-based number recognition games are effective at teaching counting skills to preschoolers (Mattoon et al., 2015; Texas Education Agency, 2022). Couse and Chen (2010) found that manipulatives and interactive math apps allow students to build number sense while actively engaging with content. These digital games

can adapt to a child's level, offering instant feedback and scaffolding, which supports differentiated learning paths for diverse learners within the classroom.

Shape Recognition and Pattern Skills. Children using iPads develop early geometry and pattern recognition skills through dynamic, visual learning experiences. Papadakis et al. (2017) noted that digital activities scaffold complex mathematical thinking even at an early age. Many apps include interactive activities that help children identify and manipulate shapes and patterns, strengthening their spatial awareness, logic, and problem-solving abilities—skills foundational for higher-level math concepts.

Benefits for Diverse Learners. Technology offers significant benefits beyond enhancing early literacy skills; it also serves as a crucial tool for supporting students with disabilities. Assistive technology can provide tailored support to address diverse learning needs, facilitating greater access to educational opportunities and improving overall learning outcomes. "Access to appropriate assistive technology can support students' educational engagement, increase well-being and academic self-efficacy and have a positive impact in the areas of competence, adaptability and self-esteem" (McNicholl et al., 2023). Tools like text-to-speech software have been shown to improve early reading skills (Herawati et al., 2022). In addition, tools that provide step-by-step instructions can enhance independence in learners with intellectual disabilities and benefit all students by supporting focused learning (Desideri et al., 2021). These tools can be seamlessly integrated into tablet-based instruction, making learning more accessible and equitable across developmental and linguistic differences.

General Achievement in ELA and Math. In a broader quantitative analysis, Bebell and Pedulla (2015) investigated the academic impact of 1:1 iPad integration on early learners. Their

findings showed significant gains in both English Language Arts (ELA) and mathematics achievement. The results suggest that consistent exposure to technology-rich instruction using iPads can foster early academic growth across multiple domains, including literacy and numeracy. These results underscore the potential of iPads to support academic development comprehensively when implemented with purpose and structure.

Importance of Intentional Digital Instruction

According to the Pre-K guidelines, technology can enhance active, hands-on, creative, and authentic engagement with others and the world; however, it must be used with intentionality. This means that educators should thoughtfully integrate technology to support learning objectives and foster meaningful interactions. By carefully selecting tools and resources, teachers can create enriching experiences that promote critical thinking, collaboration, and exploration among young learners. Intentional use ensures that technology complements rather than distracts from the learning process, ultimately enhancing children's overall development.

Preparing for Tomorrow

In conclusion, the integration of technology in preschool education is vital for bridging gaps in learning and preparing young learners for future academic success. This review demonstrates that using age-appropriate tools, such as iPads, can enhance engagement, support skill development, and foster essential digital literacy. Research shows that technology can effectively complement traditional teaching methods, especially for students who may struggle with foundational skills. By thoughtfully incorporating digital resources, preschools can create enriched learning environments that address diverse needs and promote overall development. As children increasingly interact with technology in their daily lives, embracing these tools within

educational settings becomes imperative. This approach ensures that students are equipped with the necessary competencies to thrive in an increasingly digital world, making it a fitting solution for preschools committed to innovative and inclusive education.

Summary

This literature review demonstrates that integrating iPads into Pre-K3 classrooms offers valuable benefits for early learning and development. Research shows that intentional iPad use helps young children build important digital skills, preparing them for the technology they will encounter in kindergarten and beyond. Additionally, iPads support early literacy by strengthening phonemic awareness, vocabulary, and reading comprehension, while also enhancing early numeracy skills like counting, number recognition, and pattern identification. Technology can also play a key role in supporting diverse learners by providing tools that promote independence, confidence, and engagement. Across all areas, the success of technology integration depends on purposeful, thoughtful implementation. When used effectively, iPads can create meaningful learning experiences that help students develop strong academic foundations and set them up for long-term success in an increasingly digital world.

This Review and the Field of Education

This review shows just how important early technology integration is for the future of education. As digital tools become a bigger part of everyday learning, it's clear that giving young students early experience with iPads can help them build the skills they'll need later on. By starting in Pre-K3, we can set students up for success, not only in literacy and math but also in developing the confidence to use technology independently. It also helps teachers by creating

stronger foundations and reducing gaps that can show up later. As classrooms keep evolving with new technology, it's important that early education keeps up, making sure all students have the same opportunities to learn, grow, and thrive in a digital world.

Strengths and Weaknesses of this Body of Literature

A major strength of the literature reviewed is the consistency of findings supporting the positive impact of iPads and digital tools on preschool learning outcomes. Studies consistently demonstrate that technology can enhance student engagement, motivation, and academic development in literacy, numeracy, and digital fluency. Multiple sources, including Bebell and Pedulla (2015) and Shifflet et al. (2020), found measurable improvements in early literacy and math achievement through structured iPad use. Furthermore, the literature covers a diverse range of learners, including those with developmental delays, and highlights how assistive technologies promote inclusive education (Desideri et al., 2021; McNicholl et al., 2023). This broad representation lets the reader know that technology integration benefits a wide range of students when thoughtfully implemented. Another strength is the depth of subtopics explored within each theme, whenever I came up with the structure of the article I thought of subtopics and looked most up on google scholar to ensure that I could find articles that focused on phonemic awareness, vocabulary growth, pattern recognition, and digital independence. All of the subtopics provided a comprehensive understanding of technology's multifaceted role in early education.

Focus of the Current Study

Building on the findings from the existing literature, my action research project will investigate the implementation of iPads in a Pre-K3 classroom to enhance students' early literacy, numeracy, and digital fluency skills. The literature highlights the potential benefits of using iPads to improve phonological awareness, letter recognition, vocabulary acquisition, and early math skills in early childhood settings. It also points to the importance of fostering digital literacy and independence from an early age. However, gaps such as the lack of long-term studies, limited focus on the age group, and the challenges of practical implementation suggest that further research is needed. Since I am piloting implementation of technology through ABC mouse at my school my study will address these gaps by not only measuring academic progress but also closely observing the day-to-day integration of iPads in a real-world Pre-K3 setting. I aim to document both the successes and challenges encountered during implementation, offering a comprehensive understanding of how technology can be introduced effectively to this young age group.

References

Abdullah, M. S., Toycan, M., & Anwar, K. (2017). The cost readiness of implementing e-learning. *Custos e Agronegócio On Line, 13*(2), 156–175.

Altindag Kumas, O., Dodur, H. M. S., & Yuzbasioglu, Y. (2021). The impact of the name writing skill in preschool children on print knowledge, alphabet knowledge, and phonological awareness: The case of Turkey. *Southeast Asia Early Childhood Journal,* Vol. 10, 1–15. https://files.eric.ed.gov/fulltext/EJ1327444.pdf

Bebell, D., & Pedulla, J. (2015). A quantitative investigation into the impacts of 1:1 iPads on early learners' ELA and math achievement. *Journal of Information Technology Education: Innovations in Practice, 14*, 191–215. https://www.jite.org/documents/Vol14/JITEv14IIPp191-215Bebell1720.pdf

Couse, L. J., & Chen, D. W. (2010). A tablet computer for young children? Exploring its viability for early childhood education. *Journal of Research on Technology in Education, 43*(1), 75–98. https://files.eric.ed.gov/fulltext/EJ898529.pdf

Desideri, L., Lancioni, G., Malavasi, M., Gherardini, A., & Cesario, L. (2021). Step-instruction technology to help people with intellectual and other disabilities perform multi step tasks: A literature review. *Journal of Developmental and Physical Disabilities, 33*(6), 857–886. https://doi.org/10.1007/s10882-020-09781-7

Lee, Y. (2009). Pre-K children’s interaction with educational software programs: An observation of capabilities and levels of engagement. *Journal of Educational Multimedia and Hypermedia, 18*(3), 289–309. https://doi.org/10.1007/s10882-020-09781-7

Mashyhura, Nufaisah & Hadikusuma Ramadan, Zaka. (2021). Implementation of Digital Literacy in Elementary Schools. *International Journal of Elementary Education*.*5*(4), 639–647. https://doi.org/10.23887/ijee.v5i4.39480.Mattoon, C.,

Bates, A., Shifflet, R., Latham, N., & Ennis, S. (2015). Examining computational skills in pre kindergarteners: The effects of traditional and digital manipulatives in a prekindergarten classroom. *Early Childhood Research & Practice, 17*(1). https://files.eric.ed.gov/fulltext/EJ1072360.pdf

McNicholl, A., Desmond, D., & Gallagher, P. (2023). Assistive technologies, educational engagement, and psychosocial outcomes among students with disabilities in higher education. *Disability and Rehabilitation: Assistive Technology, 18*(1), 50–58. https://doi.org/10.1080/17483107.2020.1854874

Papadakis, S., Kalogiannakis, M., & Zaranis, N. (2017). Designing and creating an educational app rubric for preschool teachers. *Education and Information Technologies, 22*(6), 3147–3165. DOI:10.1007/s10639-017-9579-0.

Pangrazio, L., & Sefton-Green, J. (2021). Digital rights, digital citizenship and digital literacy: What's the difference? *Journal of New Approaches in Educational Research, 10*(1), 15–27. https://doi.org/10.7821/naer.2021.1.616

Raposo-Rivas, M., Halabi-Echeverry, A. X., Sarmiento Campos, J. A., & García-Fuentes, O. (2024). Associations among Variables in Technology-Enhanced Phonological Awareness Programmes Based on a Meta-Analysis. Education Sciences, 14(4). https://doi-org.libproxy.lamar.edu/10.3390/educsci14040343

Riyanti, A., Sagena, U., Lestari, N. C., Pramono, S. A., & Al Haddar, G. (2023). Internet-based learning in improving student digital literacy. *Cendikia: Media Jurnal Ilmiah Pendidikan, 13*(4), 585–594. https://doi.org/10.35335/cendikia.v13i4.3598.

Shifflet, R., Mattoon, C., & Bates, A. (2020). Using tablets in a prekindergarten classroom to foster phonological awareness. *International Research in Early Childhood.* DOI:10.26180/5F84706726DA5.

Texas Education Agency. (2022). *2022 Texas prekindergarten guidelines comprehensive guide*. TEA. https://tea.texas.gov/academics/early-childhood-education/2022-texas-pkg-comprehensive-guide.pdf