ISSN: 2945-4190

World Journal on Education and Humanities Research
Creative Commons Attribution 4.0 International
Vol. 4, Issue 4, pp. 90-103
Received, September 2024; Revised October 2024;
Accepted October 2024

Article

The Role of Technology in Developing Young Children's Cognitive Abilities

Jerilyn Cabahug
Helen Revalde
Kaitlin Marie Opingo
Randy Mangubat
Veronica Calasang
Roberto Suson

Corresponding Author: jerilynb2014@gmail.com

Abstract: This study examines the impact of electronic device usage on young learners' cognitive abilities and socio-emotional development, focusing on skills such as numeracy, literacy, memory, attention, and problem-solving. Using a descriptive research design, data were gathered through structured questionnaires administered to parents, with responses analyzed using correlation analysis to determine the relationships between device usage, educational content quality, and cognitive outcomes. Findings reveal that high-quality digital content significantly enhances cognitive skills, particularly in areas like social-emotional development, memory, and problem-solving, underscoring the role of adaptive digital resources in fostering personalized and flexible learning experiences. Digital literacy was also positively correlated with empathy, cooperation, and self-regulation, suggesting that guided technology use can support social-emotional growth alongside intellectual development. This study advocates for the strategic integration of electronic devices in early childhood education, emphasizing balanced digital practices that nurture both cognitive and interpersonal skills, thus supporting young learners' holistic development and lifelong learning preparedness.

Keywords: Early childhood education, Cognitive development, Digital literacy, electronic devices

Introduction

Technology's integration into everyday life has transformed communication, work, and educational practices, reshaping how individuals interact and access information (Zhao et al., 2019; Lee & Choi, 2020). In educational settings, digital tools have significantly enhanced teaching and learning by providing more accessible and interactive experiences, which greatly influence student engagement and participation (Sung et al., 2021; De Freitas & Marshall, 2022). For

young children, particularly in early childhood education, the influence of technology on cognitive development is profound. Digital tools used in homes and classrooms can impact foundational cognitive skills, such as problem-solving, memory, and attention, which are essential in this formative period (Madigan et al., 2020; Neumann, 2021; Lovato et al., 2022). Understanding these effects is crucial for educators and parents seeking to optimize learning experiences in early education (Radesky et al., 2020; Yelland, 2020).

Interactive educational technology, including apps and games, offers a unique opportunity to enhance cognitive skills in young children. For instance, memory-focused games encourage children to recall and apply information, while problem-solving apps prompt them to employ critical thinking in various scenarios (Fisher et al., 2020; Hirsh-Pasek et al., 2022). These tools often provide dynamic, engaging content tailored to a child's learning pace, which can support sustained attention and adaptive learning (Griffin & Care, 2019; Morrison et al., 2022). The ability of digital tools to create interactive and personalized learning environments facilitates cognitive growth by stimulating memory, attention, and critical thinking skills, sometimes surpassing traditional learning methods (Eisen & Lillard, 2020; Barr et al., 2021; Woolford et al., 2023).

Cognitive skills are essential in early childhood, particularly in kindergarten, where children develop foundational abilities in numeracy, literacy, memory, and problem-solving, all of which contribute to their academic success (Blair & Raver, 2019; Diamond & Ling, 2020; Schmitt et al., 2021). These skills foster information processing, adaptability, and effective problem-solving, which are integral to lifelong learning and achievement (Best et al., 2020; Burchinal & Schneider, 2019; Zelazo, 2022). Thus, supporting cognitive development from a young age is imperative to ensure children are well-prepared for future educational challenges (Richland & Burchinal, 2019; McClelland et al., 2021).

Despite considerable research on cognitive benefits, a critical gap remains in understanding the long-term effects of early digital exposure on young children's social-emotional development (Radesky et al., 2020; Zosh et al., 2021; Robinson & Ruggs, 2022). While much of the literature centers on academic outcomes, limited studies explore how digital engagement affects young learners' ability to form relationships, empathize, and navigate social contexts (Robinson et al., 2021; Livingstone & Blum-Ross, 2023). Addressing this gap is essential, as social-emotional skills are pivotal for well-rounded development, impacting later success in both personal and professional settings (Zosh & Hirsh-Pasek, 2021; Madigan et al., 2023).

This study aims to address the gap by investigating how digital exposure in early childhood impacts social-emotional development, alongside cognitive growth. Insights gained from this research may help educators and parents balance digital engagement with activities

that foster emotional intelligence and social skills (Lillard et al., 2020; Maggioni et al., 2022). The findings could contribute to educational policy, encouraging the integration of digital learning with strategies for social-emotional development, ultimately promoting holistic growth in young learners (de Wit et al., 2024; Zosh et al., 2021).

Methodology

This study employed a descriptive research design to investigate the impact of electronic device usage on young children's cognitive abilities. Data collection involved a structured questionnaire adapted from established, validated instruments, with a foundation in contemporary research on technology integration in early childhood education (Neumann & Neumann, 2019; Hwang et al., 2020; Richland et al., 2019; Best, 2020; Schmitt et al., 2021). The questionnaire assessed cognitive skills such as memory, attention, and problem-solving, focusing on the specific effects of digital tool usage aligned with the study's objectives. A transmittal letter was initially sent to the school principal to request permission for the research. Once approved, the questionnaires were distributed to teachers, who then passed them on to parents, ensuring that participants remained anonymous and that data were kept confidential. Responses were recorded on a 5-point Likert scale, ranging from "Strongly Disagree" (1.00–1.80) to "Strongly Agree" (4.21–5.00), to measure perceptions of the influence of electronic devices on cognitive development. For data analysis, statistical software was utilized, with a significance level set at 0.05. Correlation analysis examined the relationship between electronic device usage and cognitive skills, highlighting patterns and potential impacts. This research followed an INPUT-PROCESS-OUTPUT framework to systematically organize each phase, evaluating digital exposure's role in early cognitive development.

Results and Discussion

Table 1. Educational Content Accessibility

Educational Content Accessibility	Mean	VD
Electronic devices provide access to a wide range of learning materials, including apps, ebooks, and educational videos, catering to different learning styles and preferences.	4.65	SA
Learners can access educational content anytime and anywhere, making learning opportunities more flexible and ubiquitous.	4.12	A
Many electronic resources offer interactive features, such as games and quizzes, which can enhance engagement and retention of information.	4.55	SA
Adaptive learning technologies can tailor content to the individual learning pace and level of each student, addressing their specific needs and challenges.	4.48	SA
Devices can integrate text, audio, visuals, and animation, providing a rich, multisensory learning experience that can aid in the understanding of complex concepts.	4.54	SA
Grand Mean	4.47	SA

The data in Table 1 underscores the significant positive influence of electronic devices on learners. The highest mean score (4.65) indicates a strong consensus that electronic devices provide access to a diverse range of learning materials, such as apps, ebooks, and educational videos, which cater to various learning styles and preferences. This variety supports personalized learning experiences. The flexibility and ubiquity of learning opportunities enabled by these devices are also well-regarded, with a mean score of 4.12, suggesting that learners appreciate the ability to access educational content anytime and anywhere. Furthermore, the interactive features of electronic resources, including games and quizzes, are seen as highly beneficial, enhancing engagement and retention of information, as evidenced by a mean score of 4.55. Adaptive learning technologies that customize content to individual learning paces and levels receive a mean score of 4.48, highlighting their effectiveness in addressing specific learner needs. Additionally, the integration of text, audio, visuals, and animations in learning devices is valued for providing a rich, multisensory learning experience, aiding the understanding of complex concepts, as reflected in a mean score of 4.54.

Table 2. Learning Ability

Learning Ability	Mean	VD
Learners are willing to spend more time on learning activities when engaged with interactive and multimedia content.	4.64	SA
Learners show active participation in tasks that involve electronic devices, indicating heightened interest and engagement.	4.68	SA
There is a noticeable eagerness among learners to engage with new digital learning materials.	4.65	SA
Children develop positive attitudes towards learning when they experience it through fun and interactive means.	4.61	SA
Encourage children to persist with challenging tasks, boosting their resilience in learning.	4.48	SA
Grand Mean	4.61	SA

The data presented in Table 2 highlights the positive impact of electronic devices on learners' abilities and attitudes towards learning. Learners are particularly willing to spend more time on learning activities when these activities involve interactive and multimedia content, as indicated by a high mean score of 4.64. This willingness translates into active participation in tasks involving electronic devices, with the highest mean score of 4.68, reflecting heightened interest and engagement. The eagerness to engage with new digital learning materials is also notable, with a mean score of 4.65, indicating strong enthusiasm among learners. Furthermore, children develop positive attitudes towards learning when it is facilitated through fun and interactive means, as shown by a mean score of 4.61. This positive experience encourages children to persist with challenging tasks, thereby boosting their resilience in learning, supported by a mean score of 4.48.

Table 3. Digital Literacy

Digital Literacy	Mean	VD
Learners become familiar with operating devices, using touchscreens, and navigating interfaces.	4.48	SA
Even at a basic level, children learn to access information online under guidance, laying the groundwork for research skills.	4.35	SA
Introduction to discerning reliable from unreliable digital content, fostering critical evaluation skills from an early age.	4.29	SA
Opportunities to use simple digital tools for creating art, music, or stories develop creative skills and digital fluency.	4.58	SA
Education on using devices safely can begin, including understanding privacy settings and recognizing inappropriate content.	4.29	SA
Grand Mean	4.40	SA

The data in Table 3 demonstrates the significant role of electronic devices in fostering digital literacy among learners. The familiarity with operating devices, using touchscreens, and navigating interfaces is highly rated, with a mean score of 4.48, indicating strong agreement on the importance of these foundational skills. Even at a basic level, children learning to access information online under guidance is crucial for laying the groundwork for research skills, as reflected by a mean score of 4.35. Introducing learners to the process of discerning reliable from unreliable digital content fosters critical evaluation skills early on, evidenced by a mean score of 4.29. The highest mean score of 4.58 highlights the value placed on opportunities for children to use simple digital tools for creative activities such as art, music, or storytelling, which contribute to developing both creative skills and digital fluency. Additionally, educating learners about safe device usage, including understanding privacy settings and recognizing inappropriate content, is recognized as important, with a mean score of 4.29. Overall, the grand mean of 4.40 suggests a strong consensus on the benefits of digital literacy education facilitated by electronic devices, emphasizing the development of both technical and critical thinking skills in learners.

Table 4. Numeracy Skills

Numeracy Skills	Mean	VD
Demonstrating the ability to count objects and understand that the last number represents the total quantity.	4.45	SA
Being able to recognize and name numbers up to at least 20.	4.58	SA
Starting to grasp simple addition and subtraction using physical objects or visual aids.	4.58	SA
Ability to identify and create simple patterns, recognizing sequences in their environment.	4.48	SA
Basic understanding of measurement concepts such as big/small, more/less, and comparisons between objects.	4.45	SA
Grand Mean	4.51	SA

The data in Table 4 illustrates the high level of numeracy skills among

learners, showcasing various cognitive abilities related to numerical understanding and operations. Learners demonstrate a strong ability to count objects and understand that the last number represents the total quantity, with a mean score of 4.45, indicating strong agreement. They are also proficient in recognizing and naming numbers up to at least 20, as evidenced by the highest mean score of 4.58. This proficiency extends to simple arithmetic, with learners beginning to grasp basic addition and subtraction using physical objects or visual aids, also rated at a mean score of 4.58. Furthermore, learners show a strong ability to identify and create simple patterns and recognize sequences in their environment, reflected by a mean score of 4.48. Additionally, there is a solid understanding of basic measurement concepts such as big/small, more/less, and comparisons between objects, with a mean score of 4.45. Overall, the grand mean of 4.51 indicates a strong consensus that learners possess substantial numeracy skills, demonstrating their ability to engage with fundamental mathematical concepts effectively.

Table 5. Literacy Skills

Digital Literacy	Mean	VD
Recognizing and naming letters of the alphabet in both uppercase and lowercase forms.	4.65	SA
Understanding that words are made up of sounds and being able to play with sounds (e.g., rhyming, beginning sounds).	4.61	SA
Starting to read simple words or sentences, and recognizing some sight words.	4.61	SA
Writing their own name and other simple words with assistance.	4.45	SA
Demonstrating understanding of simple stories through pictures or texts, answering questions about what they've read or heard.	4.48	SA
Grand Mean	4.56	SA

The data in Table 4 highlights the high literacy skills among learners, reflecting their strong foundational abilities in reading and writing. Learners exhibit a significant proficiency in recognizing and naming letters of the alphabet in both uppercase and lowercase forms, as indicated by the highest mean score of 4.65. They also demonstrate a solid understanding of phonemic awareness, playing with sounds through activities like rhyming and identifying beginning sounds, with a mean score of 4.61. This phonemic awareness translates into early reading skills, where learners can start reading simple words or sentences and recognize some sight words, also reflected by a mean score of 4.61. Writing skills are developing well, with learners being able to write their own name and other simple words with assistance, shown by a mean score of 4.45. Additionally, learners can comprehend simple stories through pictures or texts and answer questions about what they've read or heard, with a mean score of 4.48. The grand mean of 4.56 suggests a strong agreement that learners possess substantial literacy skills, demonstrating their ability to engage effectively with both written and spoken language.

Table 6. Memory and Recall

Memory and Recall	Mean	VD
Ability to remember information over short periods, such as following simple instructions or recalling recently learned words.	4.38	SA
Remembering the sequence of daily activities or routines.	4.42	SA
Being able to retell a simple story in their own words after hearing it.	4.45	SA
Recognizing previously seen items or images when presented among new ones.	4.45	SA
Remembering where objects are usually stored or where they were last placed.	4.46	SA
Grand Mean	4.43	SA

The data in Table 6 emphasizes the strong memory and recall abilities among learners, showcasing their capability to retain and retrieve information effectively. Learners show a notable ability to remember information over short periods, such as following simple instructions or recalling recently learned words, with a mean score of 4.38. They also demonstrate proficiency in remembering the sequence of daily activities or routines, reflected by a mean score of 4.42. The ability to retell a simple story in their own words after hearing it is also strong, with a mean score of 4.45, indicating good narrative recall skills. Additionally, learners can recognize previously seen items or images when presented among new ones, again with a mean score of 4.45, showing effective visual memory. Furthermore, learners exhibit a solid memory for locations, as indicated by a mean score of 4.46 for remembering where objects are usually stored or where they were last placed. Overall, the grand mean of 4.43 suggests a strong consensus on the robust memory and recall capabilities of learners, highlighting their effective information retention and retrieval skills.

Table 7. Attention and Concentration

Attention and Concentration	Mean	VD
Can focus on a task or activity for increasing periods, showing interest in details.	4.42	SA
Ability to switch attention from one activity to another with minimal adult assistance.	4.29	SA
Can concentrate on a specific task even with distractions present in the environment.	4.26	SA
Capable of following two- to three-step directions.	4.32	SA
Shows ability to listen and participate in group settings, like story time or group discussions.	4.45	SA
Grand Mean	4.35	SA

The data in Table 7 highlights the learners' strong attention and concentration abilities, essential for effective learning and task completion. Learners can focus on tasks or activities for extended periods, showing a keen interest in details, with a mean score of 4.42. This ability to sustain attention is complemented by their capacity to switch attention from one activity to another with minimal adult assistance, indicated by a mean score of 4.29. Despite potential

distractions in their environment, learners demonstrate a good level of concentration on specific tasks, reflected by a mean score of 4.26. They are also capable of following two- to three-step directions, with a mean score of 4.32, showing their ability to process and act on multiple instructions sequentially. Additionally, learners exhibit strong listening and participation skills in group settings, such as story time or group discussions, achieving the highest mean score of 4.45. Overall, the grand mean of 4.35 suggests a strong consensus on the learners' ability to maintain attention and concentration across various tasks and settings, indicating their readiness for more complex and collaborative learning activities.

Table 8. Social and Emotional Development

Social and Emotional Development	Mean	VD
Beginning to manage emotions with some support, can express feelings using words.	4.38	SA
Showing understanding or concern for the feelings of others.	4.42	SA
Engaging in play that involves sharing, taking turns, and collaborating with peers.	4.51	SA
Recognizing basic facial expressions and social cues of others.	4.42	SA
Showing increasing independence in personal care and in making choices.	4.51	SA
Grand Mean	4.45	SA

Table 8 presents data on the influence of electronic devices on the social and emotional development of individuals across various cognitive ability levels. Engaging in play that involves sharing, taking turns, and collaborating with peers got the highest mean of 4.51 which verbally described as “strongly agree”, indicating electronic platforms and applications as facilitator of social engagement and teamwork among learners, contributing to their social development. Similarly, showing increasing independence in personal care and in making choices also got the highest mean 4.51. Moving on to the stage of understanding or showing concern for the feelings of others, the mean score of 4.42 reinforces the notion that electronic devices contribute positively to fostering empathy and emotional awareness in individuals. Similarly, individuals advance in recognizing facial expressions and social cues, the mean score of 4.42 suggests that electronic devices can serve as effective tools for learning and practicing these skills, thereby enhancing social awareness and communication abilities. While, beginning with individuals at the stage of managing emotions with some support and expressing feelings using words, got the lowest mean score of 4.38 indicates that electronic devices may play a role in facilitating emotional expression and regulation, particularly in early developmental stages. Although its slightly lower but all the indicators reveal a strong agreement of the respondents. This suggest that technology can serve as a powerful facilitator in cultivating essential interpersonal skills and self-reliance, thereby significantly contributing to individuals' overall social development. This implies a need for

educators to embrace innovative teaching methods and digital tools that leverage technology to enhance social skills, emotional intelligence, and interpersonal communication among learners. Furthermore, the findings highlight the potential of electronic platforms and applications to promote collaboration, teamwork, and autonomy, essential skills for success in both academic and real-world contexts.

Table 9. Problem Solving Skills

Problem Solving Skills	Mean	VD
Can recognize a simple problem and express it in their own words.	4.32	SA
Comes up with basic solutions to simple problems, often through trial and error.	4.42	SA
Making choices between two or more options in play or learning tasks.	4.29	SA
Beginning to use tools or materials (e.g., puzzles, building blocks) for their intended purpose in problem-solving.	4.45	SA
Recognizing when they need help and asking for it appropriately.	4.45	SA
Grand Mean	4.39	SA

The data in Table 9 underscores the strong problem-solving skills among learners, reflecting their ability to identify and address simple problems effectively. Learners can recognize simple problems and articulate them in their own words, with a mean score of 4.32, indicating strong agreement on this skill. They also demonstrate the ability to come up with basic solutions to these problems, often using trial and error, as shown by a mean score of 4.42. When faced with choices in play or learning tasks, learners can make decisions between two or more options, reflected by a mean score of 4.29. Additionally, they are beginning to use tools or materials, such as puzzles and building blocks, for their intended purposes in problem-solving, with a high mean score of 4.45. This skill is crucial as it indicates an understanding of the functional use of objects in achieving goals. Furthermore, learners recognize when they need help and appropriately ask for it, also with a mean score of 4.45, highlighting their social awareness and ability to seek assistance when necessary.

Table 10. Significant Relationship Between Education Content quality and dimension of cognitive abilities

Cognitive Ability	r-value	t-value	p-value	Remarks	Decision
Numeracy Skills	0.806248	6.936449	0.000	Significant	Reject
Literacy Skills	0.758441	5.823959	0.000	Significant	Reject
Memory and Recall	0.758718	5.654429	0.000	Significant	Reject
Attention and Concentration	0.761351	5.383362	0.000	Significant	Reject
Social and Emotional Development	0.820276	7.394726	0.000	Significant	Reject
Problem-Solving Skills	0.804309	6.878215	0.000	Significant	Reject

The data from Table 10 reveals significant relationships between

education content quality and various dimensions of cognitive abilities. The r-values, ranging from 0.758 to 0.820, indicate strong positive correlations. Social and emotional development shows the highest correlation with education content quality (r = 0.820), followed closely by numeracy skills (r = 0.806), problem-solving skills (r = 0.804), attention and concentration (r = 0.761), memory and recall (r = 0.759), and literacy skills (r = 0.758). The t-values further substantiate these correlations, with the highest being 7.395 for social and emotional development, emphasizing the strength of this relationship. All p-values are 0.000, confirming the statistical significance of these findings. These results suggest that high-quality educational content is significantly associated with enhanced cognitive abilities across various dimensions, particularly in social and emotional development, numeracy, and problem-solving skills. This underscores the critical role of high-quality educational content in fostering comprehensive cognitive development.

Table 11. Significant Relationship Between Learning Ability and dimension of cognitive abilities

Cognitive Ability	r-value	t-value	p-value	Remarks	Decision
Numeracy Skills	0.712933	4.731015	0.000	Significant	Reject
Literacy Skills	0.69034	4.366106	0.000	Significant	Reject
Memory and Recall	0.802831	5.977019	0.000	Significant	Reject
Attention and Concentration	0.741895	4.637591	0.000	Significant	Reject
Social and Emotional Development	0.793203	6.140721	0.000	Significant	Reject
Problem-Solving Skills	0.771431	5.632594	0.000	Significant	Reject

The data from Table 11 indicates significant relationships between learning ability and various dimensions of cognitive abilities. The r-values, ranging from 0.690 to 0.803, indicate strong positive correlations. Memory and recall show the highest correlation with learning ability (r = 0.803), followed by social and emotional development (r = 0.793), problem-solving skills (r = 0.771), attention and concentration (r = 0.742), numeracy skills (r = 0.713), and literacy skills (r = 0.690). The corresponding t-values are also substantial, with memory and recall exhibiting the highest t-value of 5.977, underscoring the strength of these relationships. All p-values are 0.000, confirming the statistical significance of these correlations. These findings suggest that enhanced learning abilities are significantly associated with improved cognitive abilities across various dimensions, particularly in memory, social and emotional development, and problem-solving skills. This underscores the importance of fostering learning abilities to achieve comprehensive cognitive development.

The data from Table 12 reveals significant relationships between digital literacy and various dimensions of cognitive abilities. The r-values indicate very strong positive correlations, ranging from 0.728 to 0.889.

Table 12. Significant Relationship Between Digital Literacy and dimension of cognitive abilities

Cognitive Ability	r-value	t-value	p-value	Remarks	Decision
Numeracy Skills	0.83914	8.766051	0.000	Significant	Reject
Literacy Skills	0.727654	5.926924	0.000	Significant	Reject
Memory and Recall	0.844336	8.540666	0.000	Significant	Reject
Attention and Concentration	0.781346	6.407421	0.000	Significant	Reject
Social and Emotional Development	0.888877	11.16844	0.000	Significant	Reject
Problem-Solving Skills	0.840502	8.800529	0.000	Significant	Reject

Social and emotional development shows the highest correlation with digital literacy (r = 0.889), followed by memory and recall (r = 0.844), problem-solving skills (r = 0.841), numeracy skills (r = 0.839), attention and concentration (r = 0.781), and literacy skills (r = 0.728). The t-values are also high, with social and emotional development exhibiting the highest t-value of 11.168, indicating the robustness of these relationships. All p-values are 0.000, confirming the statistical significance of these correlations. These findings suggest that higher digital literacy is strongly associated with enhanced cognitive abilities across various dimensions, particularly in social and emotional development, memory, and problem-solving skills. This underscores the critical role of digital literacy in fostering comprehensive cognitive development.

Discussion

The study's results underscore the positive influence of electronic devices on various dimensions of young learners' cognitive development, particularly in fostering foundational skills such as numeracy, literacy, and problem-solving. High accessibility to educational content, as demonstrated by the significant mean scores in the data, moreover, electronic devices effectively support personalized and flexible learning environments that cater to diverse learning styles and preferences (Neumann & Neumann, 2019; Zhao et al., 2020). The data reveal a strong correlation between the quality of educational content accessed through digital platforms and learners' social-emotional development, suggesting that well-designed educational technology can enhance not only cognitive but also socio-emotional skills. This finding aligns with existing research highlighting the role of interactive digital content in promoting engagement, which is essential for retention and comprehension in young learners (Radesky & Christakis, 2020; Hirsh-Pasek et al., 2022). Furthermore, digital tools that support adaptive learning allow children to progress at their own pace, providing a tailored educational experience that addresses individual needs (De Freitas & Marshall, 2022).

The study also highlights the significance of digital literacy as a crucial factor in cognitive development, particularly in enhancing social-

emotional and memory skills. These findings align with the broader literature, which suggests that early exposure to digital literacy not only develops technical proficiency but also supports critical thinking and emotional intelligence (Livingstone & Blum-Ross, 2023; Zosh et al., 2021). Notably, the high correlation between digital literacy and social-emotional skills suggests that guided interaction with technology can foster empathy, self-regulation, and cooperation among young learners, which are essential for social success and well-being (Madigan et al., 2023; Robinson & Ruggs, 2022). Moreover, the relationship between learning ability and memory, emphasizes the importance of technology in reinforcing cognitive skills through repetitive, engaging activities. This result supports the growing recognition of educational technology as a vehicle for holistic development, encouraging educators to adopt balanced digital practices that nurture both cognitive and socio-emotional growth (Zhao et al., 2019; Morrison et al., 2022). These findings suggest that technology, when thoughtfully integrated, can serve as a powerful tool in early childhood education, providing opportunities for inclusive, comprehensive, and adaptive learning experiences.

Conclusion

In conclusion, this study demonstrates that electronic devices, when integrated effectively, can positively impact young learners' cognitive abilities and socio-emotional development, reinforcing foundational skills such as numeracy, literacy, memory, attention, and problem-solving. The high correlations between educational content quality, digital literacy, and various cognitive dimensions suggest that access to interactive, well-structured digital resources can create engaging and supportive learning environments that foster both intellectual and emotional growth. The significant association between digital literacy and social-emotional skills further highlights the potential for technology to cultivate empathy, cooperation, and self-regulation among young children, offering a balanced approach to early education that nurtures the whole child. These findings advocate for the intentional incorporation of digital tools in educational settings, encouraging educators and policymakers to prioritize high-quality, adaptive content that aligns with developmental needs. Fostering digital literacy and a balanced digital experience, educational institutions can support young learners' holistic development, equipping them with the cognitive and interpersonal skills essential for lifelong learning and success.

References

Barr, R., Lauricella, A. R., & Wartella, E. (2021). Parent-child interactions and screen media use in children's development. *Annual Review of Developmental Psychology*, 3, 159-179.
Best, J. R. (2020). Improving executive function in early childhood: Evaluation of a self-regulation curriculum. *Early Childhood Research Quarterly*, 50, 113-125.
Blair, C., & Raver, C. C. (2019). School readiness and self-regulation: A developmental psychobiological approach. *Annual Review of Psychology*, 70, 533-558.
Burchinal, M., & Schneider, W. (2019). The impact of early education on children's growth and development. *Child Development Perspectives*, 13(1), 45-50.
De Freitas, S., & Marshall, J. (2022). Adaptive learning environments: Towards a theory of flexible learning. *British Journal of Educational Technology*, 53(5), 1245-1263.
Diamond, A., & Ling, D. S. (2020). Review: Executive functions and social cognition in early childhood. *Child Development*, 91(2), 429-441.
Eisen, S., & Lillard, A. S. (2020). Technology and learning in early childhood. *Journal of Early Childhood Research*, 18(2), 125-137.
Fisher, E. L., Reynolds, C. E., & Zosh, J. M. (2020). Cognitive benefits of play and learning through interactive media. *Developmental Psychology*, 56(4), 610-621.
Griffin, P., & Care, E. (2019). Using assessment to support the development of young learners' cognitive skills. *Educational Assessment*, 24(1), 17-34.
Hirsh-Pasek, K., Zosh, J. M., & Fisher, E. L. (2022). Technology and child development: Closing the learning gap. *Frontiers in Psychology*, 13, 845678.
Hwang, G. J., & Wang, S. Y. (2020). Digital game-based learning in preschool education. *Educational Technology Research and Development*, 68(2), 631-648.
Lee, S., & Choi, H. (2020). Impact of digital media use on children's cognitive and social development. *Journal of Educational Computing Research*, 58(2), 220-245.
Livingstone, S., & Blum-Ross, A. (2023). The value of digital literacy in early childhood education. *Media, Culture & Society*, 45(3), 459-474.
Lovato, S., Owens, J. A., & Neumann, M. M. (2022). Influence of digital device use on young children's sleep and development. *Sleep Health*, 8(1), 67-76.
Madigan, S., McArthur, B. A., & Christakis, D. (2020). Digital media and its effect on childhood development: A systematic review. *Pediatrics*, 145(4), e20190221.
Maggioni, L., Fox, E., & Taylor, S. (2022). Promoting cognitive development through media: Balancing digital use with skill-building activities. *Educational Media International*, 59(1), 25-39.

McClelland, M. M., Cameron, C. E., & Morrison, F. J. (2021). Self-regulation and academic success in early childhood. *Developmental Psychology*, 57(8), 1370-1383.
Morrison, F. J., Cameron, C. E., & Nelson, L. G. (2022). Early education and the role of technology in supporting learning. *Child Development Perspectives*, 16(2), 75-81.
Neumann, M. M., & Neumann, D. L. (2019). The role of digital media in early childhood education. *Educational Psychology*, 39(7), 932-945.
Radesky, J. S., & Christakis, D. A. (2020). Increased screen time: Effects on young children's development. *JAMA Pediatrics*, 174(5), 489-492.
Richland, L. E., Burchinal, M., & Schneider, W. (2019). Early math learning in childhood education. *Educational Psychology Review*, 31(3), 743-764.
Robinson, J. P., & Ruggs, R. (2022). Screen time and social development in early childhood: A longitudinal study. *Early Childhood Research Quarterly*, 60, 40-52.
Schmitt, S. A., Pratt, M. E., & McClelland, M. M. (2021). Cognitive flexibility in early childhood and its implications. *Frontiers in Psychology*, 12, 663974.
Sung, Y. T., Chang, K. E., & Liu, T. C. (2021). Digital learning and engagement in early childhood education. *Journal of Educational Technology*, 55(3), 415-428.
Yelland, N. (2020). Digital pedagogies in early childhood education: Exploring the impact on cognitive skills. *Early Childhood Education Journal*, 48(6), 805-814.
Zelazo, P. D. (2022). Executive function in early childhood: Implications for education and learning. *Annual Review of Developmental Psychology*, 4, 93-120.
Zhao, Y., Liu, Y., & Neumann, M. (2019). Technology's impact on children's learning experiences: A meta-analysis. *Educational Research Review*, 28, 100292.
Zosh, J. M., Hirsh-Pasek, K., & Michnick Golinkoff, R. (2021). The importance of balancing digital and traditional learning. *Frontiers in Psychology*, 12, 624444.

