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Buriyeva Nilufar,
Master’s graduate of New Uzbekistan University
Abdurakhimova Madina,
Master’s student at New Uzbekistan University
Quldosheva Muazzam,
Bachelor’s graduate of Bukhara State University

SHOULD CHILDREN LEARN TO USE AI BEFORE READING AND WRITING?

Abstract. Artificial intelligence (AI) is increasingly becoming part of children's everyday lives, raising important questions about when and how young learners should be introduced to these technologies. This study explores public perceptions of whether children should learn to use AI before acquiring independent reading and writing skills. A quantitative survey was conducted among 351 respondents in Uzbekistan, including parents, school and preschool teachers, university lecturers, students, researchers, and individuals from other professional backgrounds. Data were collected through an online questionnaire distributed via Telegram and analysed using descriptive statistics. The findings indicate that 89.2% of respondents were very or somewhat familiar with ChatGPT. While only 27% agreed or strongly agreed that AI could support children's language development before literacy acquisition, 81.1% expressed positive views about voice-based AI tools for second-language learning. Furthermore, 59.5% believed that children should be introduced to AI after the age of ten. These findings reveal a distinction between general attitudes towards early AI use and perceptions of its specific educational applications. The study concludes that AI literacy may become a valuable component of early education, provided that its implementation is age-appropriate, guided by adults, and designed to complement rather than replace foundational literacy skills, human interaction, and independent learning.

Keywords: artificial intelligence, AI literacy, young children, early childhood education, reading, writing, language development, public perceptions, voice-based AI.

BOLALAR O‘QISH VA YOZISHNI O‘RGANISHDAN OLDIN SUN’IY INTELLEKTDAN FOYDALANISHNI O‘RGANISHLARI KERAKMI?

Annotatsiya. Sun’iy intellekt (SI) bolalarning kundalik hayotiga tobora ko‘proq kirib kelmoqda. Bu esa bolalarni mazkur texnologiyalar bilan qachon va qanday tanishtirish kerakligi masalasini dolzarb qilmoqda. Ushbu tadqiqot bolalar mustaqil o‘qish va yozishni o‘zlashtirishidan oldin sun’iy intellektdan foydalanishni o‘rganishi kerakligi haqidagi jamoatchilik fikrini o‘rganishga qaratilgan. O‘zbekistonda 351 nafar respondent, jumladan, ota-onalar, maktab va maktabgacha ta’lim pedagoglari, universitet o‘qituvchilari, talabalar, tadqiqotchilar hamda boshqa kasb vakillari ishtirokida miqdoriy so‘rov o‘tkazildi. Ma’lumotlar Telegram orqali tarqatilgan onlayn anketa yordamida to‘planib, tavsifiy statistika usulida tahlil qilindi. Natijalarga ko‘ra, respondentlarning 89,2 foizi ChatGPT vositasidan yaxshi yoki ma’lum darajada xabardor. Respondentlarning atigi 27 foizi sun’iy intellekt savodxonlik ko‘nikmalari shakllanishidan oldin bolalarning til rivojlanishini qo‘llab-quvvatlashi mumkin degan fikrga qo‘shilgan yoki qat’iy qo‘shilgan.

Biroq 81,1 foiz ishtirokchi ikkinchi tilni o‘rganishda ovozli sun’iy intellekt vositalarini ijobiy baholagan. Shuningdek, respondentlarning 59,5 foizi bolalarni sun’iy intellekt bilan o‘n yoshdan keyin tanishtirish maqsadga muvofiq deb hisoblagan. Natijalar sun’iy intellektdan erta foydalanishga umumiy munosabat bilan uning muayyan ta’limiy imkoniyatlariga berilgan baho o‘rtasida farq mavjudligini ko‘rsatadi. Tadqiqot xulosasiga ko‘ra, sun’iy intellekt savodxonligi yoshga mos, kattalar nazorati ostida va bolalarning asosiy o‘qish-yozish ko‘nikmalari, jonli muloqoti hamda mustaqil o‘rganishini almashtirmaydigan tarzda joriy etilishi lozim.

Kalit so‘zlar: sun’iy intellekt, sun’iy intellekt savodxonligi, yosh bolalar, maktabgacha ta’lim, o‘qish, yozish, til rivojlanishi, jamoatchilik fikri, ovozli sun’iy intellekt.

ДОЛЖНЫ ЛИ ДЕТИ НАУЧИТЬСЯ ПОЛЬЗОВАТЬСЯ ИСКУССТВЕННЫМ ИНТЕЛЛЕКТОМ ДО ТОГО, КАК ОНИ НАУЧАТСЯ ЧИТАТЬ И ПИСАТЬ?

Аннотация. Искусственный интеллект (ИИ) всё активнее становится частью повседневной жизни детей, что вызывает важные вопросы о том, когда и каким образом следует знакомить детей с этими технологиями. В статье рассматривается общественное мнение о целесообразности обучения детей использованию ИИ до освоения самостоятельного чтения и письма. Количественное исследование было проведено в Узбекистане с участием 351 респондента, включая родителей, школьных и дошкольных педагогов, преподавателей вузов, студентов, исследователей и представителей других профессиональных групп. Данные были собраны посредством онлайн-анкеты, распространённой через Telegram, и проанализированы с использованием описательной статистики. Результаты показали, что 89,2% участников хорошо или в определённой степени знакомы с ChatGPT. При этом лишь 27% респондентов согласились или полностью согласились с тем, что ИИ может способствовать развитию языковых навыков детей до освоения чтения и письма, тогда как 81,1% положительно оценили возможности голосовых инструментов ИИ для изучения второго языка. Кроме того, 59,5% участников считают, что знакомить детей с ИИ следует после достижения десяти лет. Полученные результаты свидетельствуют о различии между общим отношением к раннему использованию ИИ и оценкой его конкретных образовательных возможностей. Сделан вывод о том, что грамотность в области ИИ может стать полезной частью раннего образования при условии возрастной уместности, сопровождения со стороны взрослых и сохранения приоритета базовых навыков чтения, письма, живого общения и самостоятельного обучения.

Ключевые слова: искусственный интеллект, грамотность в области ИИ, дети раннего возраста, дошкольное образование, чтение, письмо, языковое развитие, общественное мнение, голосовые технологии ИИ.

INTRODUCTION

Artificial intelligence (AI) is becoming an increasingly visible part of children's everyday lives, and families are already using AI-powered applications at home. A survey conducted in the United Kingdom reported that 67.8% of parents had used generative AI with their children in some way, while slightly more than half believed that it could improve children's literacy skills (Picton et al., 2026). However, parents

expressed differing views about whether children should use AI, indicating that the educational value and appropriate timing of early AI exposure remain subjects of debate.

Researchers have also begun to examine whether AI education can start before formal schooling. Su and Yang (2024) suggest that AI and robotics concepts can be introduced to young children through play, storytelling, and role-play. Similarly, Xu et al. (2022) found that preschool-aged children interacting with a conversational agent demonstrated improvements in story comprehension and engagement. These findings suggest that conversational technologies may support certain learning activities even before children acquire independent reading and writing skills.

Nevertheless, introducing AI at an early age also raises developmental, educational, and ethical concerns. Young children may have difficulty distinguishing reliable information from inaccurate AI-generated responses. Unsupervised use may also raise concerns about privacy, excessive screen exposure, and dependence on technological assistance. Nikolopoulou (2025) emphasises the importance of child-centred approaches that balance the potential benefits of generative AI with the developmental needs of young learners.

Foundational literacy skills require active practice. Ibaibarriaga et al. (2025) examined handwriting and typing in children's letter and word learning, highlighting the importance of considering how different learning activities contribute to literacy development. Furthermore, Madigan et al. (2020) found associations between children's screen use and language skills, with educational content and caregiver co-use showing more favourable associations. These findings reinforce the importance of distinguishing between different forms of technology use rather than treating all digital activities as equivalent.

Another important issue concerns the meaning of AI literacy. Learning with AI is not necessarily the same as learning about AI. Children may be able to interact with an AI application without understanding how it produces responses, why its information may be inaccurate, or when adult assistance is needed. Consequently, early AI education should consider not only access to technology but also children's ability to use it critically, safely, and appropriately.

Although existing studies have explored AI-supported learning, conversational agents, and children's understanding of intelligent technologies, the question of whether children should learn to use AI before acquiring independent reading and writing skills requires further investigation. In particular, public perceptions in Uzbekistan remain an important area for exploration.

The purpose of this study is to investigate public perceptions of introducing AI to children before they learn to read and write independently. Specifically, the study examines respondents' familiarity with AI tools, their views on the appropriate age for AI introduction, their attitudes towards AI-supported language development, and their perceptions of voice-based AI for second-language learning.

The study addresses the following research questions:

1. How familiar are respondents with AI tools such as ChatGPT?
2. At what age do respondents believe children should first be introduced to AI, and should this occur before they learn to read and write independently?
3. What do respondents consider appropriate ways for young children to interact with AI, and do they believe voice-based AI can support second-language learning?
4. Do perceptions of AI differ among parents, teachers, lecturers, students, and other respondents?

LITERATURE REVIEW

AI in Early Childhood Education. The integration of AI into early childhood education has attracted increasing academic attention. Su and Yang (2024) discuss how AI and robotics can be incorporated into early learning through developmentally appropriate activities. Their approach suggests that young children can begin exploring basic AI-related concepts through interactive experiences rather than formal technical instruction.

Nikolopoulou (2025) also examines the opportunities and challenges associated with generative AI in early learning. Potential benefits include personalised educational experiences, interactive storytelling, and language support. However, these opportunities must be considered alongside concerns about privacy, excessive screen exposure, unequal access, and the possibility of reducing meaningful human interaction.

A review by Ljungcrantz (2026), covering 39 studies published between 2020 and 2024, identifies the growing interest in AI applications in early childhood education while highlighting gaps in the available evidence. The review points to the need for further research into long-term outcomes, appropriate pedagogical approaches, and ethical guidelines.

Together, these studies indicate that AI can provide additional learning opportunities, but its educational value depends on how it is designed, introduced, and supervised.

Children's Language Development and Digital Technologies. Language development depends on meaningful communication, listening, interaction, repetition, and opportunities to use language in different contexts. AI-powered conversational tools may offer additional opportunities to practise these skills.

Xu et al. (2022) investigated the use of a conversational agent to support story comprehension among children. Their findings suggest that conversational interaction with an AI-based agent can promote engagement and support particular aspects of comprehension. This provides a relevant foundation for investigating whether voice-based AI can support early language-learning activities.

However, evidence about general screen use should not be interpreted as direct evidence about AI. Madigan et al. (2020), in a systematic review and meta-analysis involving 42 studies and 18,905 children, found that greater screen time was

associated with lower language skills, whereas educational content and watching together with caregivers were associated with stronger language skills. These findings concern screen use broadly and do not establish that AI itself causes either positive or negative developmental outcomes.

Ibaibarriaga et al. (2025) examined handwriting and typing in children's learning of letters and words. Their research is relevant to the broader question of how children develop foundational literacy skills and why digital tools should not automatically replace activities involving handwriting and direct practice.

Overall, previous research suggests that technology may complement language learning, but its contribution should be evaluated according to the specific activity, learning objective, and level of adult involvement.

AI Literacy and Children's Understanding of Intelligent Technologies. AI literacy involves more than knowing how to operate a technological tool. It also includes developing an age-appropriate understanding of what AI can do, recognising its limitations, and learning to question the information it provides.

Bernstein and Crowley (2008) investigated young children's beliefs about robot intelligence. Their research provides insight into how children understand intelligent technologies and distinguish their capabilities from those of familiar living beings.

Ali et al. (2021) explored children's roles as creators, thinkers, and citizens in an AI-driven future. Their work highlights the importance of preparing children to engage thoughtfully with AI-generated content and the wider implications of intelligent technologies.

These studies suggest that children may interact successfully with AI without fully understanding how it works. For example, a child might repeat a pronunciation suggested by an AI tool without knowing whether it is accurate. Adult guidance can therefore help children verify information, understand unfamiliar words, and combine AI-assisted practice with communication and learning activities involving other people.

Jia et al. (2025) also highlight the need for greater conceptual clarity regarding AI literacy. The lack of agreement about what AI literacy should include for children makes it difficult to establish consistent educational objectives and assess outcomes across different learning contexts.

Public Perceptions and the Research Gap. Public perceptions influence how families and educators introduce new technologies to children. Picton et al. (2026) examined parents' use of AI to support literacy at home, showing the relevance of family attitudes to the integration of AI into children's learning experiences.

Nevertheless, general attitudes towards AI may differ from opinions about particular educational applications. People may have reservations about introducing AI to preschool children while recognising the possible value of voice-based tools for language practice.

Existing research has examined AI-supported learning, children's understanding of intelligent technologies, screen use, and the potential benefits of

conversational agents. However, these topics do not fully answer whether children should begin learning to use AI before acquiring independent reading and writing skills.

The present study addresses this issue by examining the perceptions of 351 respondents in Uzbekistan. It considers both general attitudes towards early AI use and opinions about a specific application: voice-based AI for second-language learning. By examining these perspectives together, the study provides an initial picture of how respondents evaluate the possible role of AI in children's early education.

METHODOLOGY

Research Design. This study used a quantitative survey to explore public perceptions of whether children should learn to use AI before acquiring independent reading and writing skills.

Participants and Sampling. A total of 351 respondents from Uzbekistan participated, including parents, teachers, lecturers, students, researchers, and others. Convenience sampling was used, with the questionnaire distributed via Telegram. Therefore, the findings may not represent the entire population of Uzbekistan.

Research Instrument. Data were collected through a researcher-developed questionnaire containing 25 questions on demographics, familiarity with ChatGPT, the appropriate age for AI introduction, and AI-supported language learning. The questionnaire included multiple-choice and Likert-scale items.

Data Collection and Analysis. Responses were collected online using Google Forms and analysed through descriptive statistics, including frequencies and percentages. The analysis focused on AI familiarity, preferred introduction age, and perceptions of early language learning. No inferential statistical tests were conducted.

Ethical Considerations. Participation was voluntary, and respondents were informed about the study's purpose. Privacy was considered during data collection and handling.

Use of AI. AI tools assisted in checking the consistency of statistical data and percentages. The findings were based on the original survey responses.

RESULTS

Participants' Demographic Characteristics. A total of 351 respondents participated in the survey. The questionnaire collected information about participants' ages, professional backgrounds, and familiarity with ChatGPT.

Regarding age, 40% of respondents were between 25 and 30 years old. Participants aged 15–20 and 30–35 each accounted for 20% of the sample, while 17.5% were between 20 and 25 years old. The remaining 2.5% were over 45. These figures indicate that respondents aged 25–30 constituted the largest reported age group.

In terms of professional background, school and preschool teachers represented the largest group, accounting for 43.2% of respondents. Students made up 18.9%,

and parents accounted for 13.5%. In addition, 10.8% selected other professional roles, 8.1% identified themselves as researchers, and 5.4% were university lecturers.

These results indicate that the survey included respondents with varied educational and professional experiences, with a particularly strong representation of school and preschool educators.

The age and occupation percentages reported in the original survey summary should be checked against the raw dataset before publication, because the reported percentages do not all align with a single denominator of 351.

Familiarity with ChatGPT. Respondents were asked about their familiarity with ChatGPT. The results showed that 59.5% were very familiar with the tool, while 29.7% were somewhat familiar with it. A further 8.1% had heard of ChatGPT but had never used it, and 2.7% reported no familiarity with it.

Overall, 89.2% of respondents reported being very or somewhat familiar with ChatGPT. This suggests that the tool was widely recognised among the surveyed participants.

However, familiarity with ChatGPT does not necessarily indicate that respondents possess a detailed understanding of how AI works, how its outputs should be evaluated, or how it can be used appropriately with young children.

Perceptions of AI and Early Language Development. One of the central survey questions examined whether respondents believed AI could support children's language development before they learned to read and write independently.

The results showed that 51.4% neither agreed nor disagreed with the statement. Meanwhile, 24.3% agreed that AI could support language development, and 2.7% strongly agreed. In contrast, 13.5% disagreed, while 8.1% strongly disagreed.

Combining the response categories, 27% expressed agreement and 21.6% expressed disagreement. The largest group remained neutral about the potential role of AI in language development before literacy acquisition.

These findings suggest that respondents did not share a clear consensus on whether AI should support language development before children learn to read and write. Although some participants recognised possible benefits, a considerable proportion remained uncertain or expressed reservations.

The neutral responses may reflect different expectations, limited information, concerns about developmental readiness, or uncertainty about appropriate uses of AI. However, because the questionnaire did not directly investigate the reasons behind these responses, these explanations remain possibilities rather than established findings.

Views on Voice-Based AI for Second-Language Learning. Another survey question asked whether voice-based AI tools could help young children learn a second language, such as English.

More than half of the respondents, 51.4%, believed that these tools could help children to some extent. A further 29.7% believed that voice-based AI could help significantly. In contrast, 8.1% selected "probably not," and another 8.1% were

unsure. Only 2.7% believed that voice-based AI would definitely not help children learn a second language.

Overall, 81.1% expressed a positive view of voice-based AI for second-language learning. This represents a clear majority of the reported responses.

The findings suggest that respondents were generally receptive to using voice-based AI as a possible additional resource for children's English learning. Such tools may be perceived as useful because they allow children to listen to words, repeat phrases, and practise speaking without needing to type or read independently.

Nevertheless, the survey measured perceptions rather than children's actual learning outcomes. The results therefore do not establish whether voice-based AI improves vocabulary, pronunciation, listening comprehension, or speaking proficiency.

Opinions on the Appropriate Age for AI Introduction. Respondents were also asked at what age children should first be introduced to AI tools.

The majority, 59.5%, believed that children should begin using AI after the age of ten. Meanwhile, 18.9% selected the age range of 8–10 years, and 13.5% considered ages 5–8 appropriate. Only 8.1% believed that children could be introduced to AI between the ages of three and five.

These findings indicate a general preference for introducing AI at a later stage of childhood. Relatively few respondents supported its introduction during the preschool years.

However, the appropriate age for introducing AI may depend on the purpose of use, the design of the application, the child's developmental readiness, and the level of adult supervision. The survey results reflect respondents' preferences and should not be interpreted as establishing a universal age threshold for AI use.

Comparison of General Attitudes and Specific Educational Applications. A comparison of responses concerning early language development and voice-based AI reveals an important difference in participants' perceptions.

While 27% agreed or strongly agreed that AI could support language development before children learn to read and write, 81.1% believed that voice-based AI could help children learn a second language to some extent or significantly.

This difference suggests that respondents were more positive about a specific application of AI than about the broader idea of using AI before children acquire foundational literacy skills.

One possible explanation is that voice-based language practice is relatively easy to connect with familiar educational activities, such as listening, repeating words, and practising pronunciation. In contrast, the broader concept of AI use before literacy may raise questions about children's readiness, independent thinking, and the role of technology in early development.

The survey did not directly investigate why respondents held these views. Therefore, the explanation should be treated as a possible interpretation rather than a confirmed finding.

Taken together, the results show that participants were generally familiar with ChatGPT and receptive to the potential use of voice-based AI for second-language learning. At the same time, they expressed uncertainty about the broader role of AI in children's language development before independent reading and writing.

DISCUSSION

Public Perceptions of AI Before Literacy Acquisition. The findings show mixed views on introducing AI before children learn to read and write independently. Only 27% of respondents agreed or strongly agreed that AI could support early language development, while 21.6% disagreed and 51.4% remained neutral. This uncertainty may reflect concerns about children's developmental readiness and the educational value of AI. Ljungcrantz (2026) similarly highlighted gaps in research on AI in early childhood education. Further studies are therefore needed to understand parents' and educators' attitudes.

Why Are Respondents More Positive About Voice-Based AI? Although only 27% supported AI use before literacy acquisition, 81.1% viewed voice-based AI positively for second-language learning. This difference may reflect the familiarity of activities such as listening, repeating words, and practising conversations. Xu et al. (2022) found that conversational agents could support children's story comprehension and engagement. However, their findings do not directly demonstrate improvements in second-language proficiency. Future research should examine changes in children's vocabulary, pronunciation, listening, and speaking skills.

AI Literacy and Children's Understanding of Technology. Using AI does not necessarily mean understanding its limitations. Children may interact with voice assistants without recognising that their responses can be inaccurate. Bernstein and Crowley (2008) and Ali et al. (2021) highlight the importance of understanding intelligent technologies and AI-generated information. Therefore, early AI education should teach children to question information, recognise possible errors, and seek adult guidance.

Opportunities and Challenges of AI in Early Learning. AI can support personalised practice, interactive storytelling, and language learning. However, concerns remain regarding privacy, information reliability, screen exposure, and reduced human interaction. Nikolopoulou (2025) emphasises balancing AI's educational potential with developmental and ethical considerations. Madigan et al. (2020) also found associations between screen use and children's language skills, although their research did not specifically examine AI. AI should therefore complement, rather than replace, play, handwriting, storytelling, and face-to-face communication.

Implications for Early Education in Uzbekistan. The findings suggest that voice-based AI could provide additional opportunities for English language practice in Uzbekistan. Parents and teachers should select age-appropriate tools, supervise their use, and verify the information provided. AI should remain a supplementary resource that supports, rather than replaces, foundational literacy instruction. Further

research should explore its effectiveness among children who speak Uzbek and other home languages.

Limitations and Future Research. This study used convenience sampling and an online questionnaire involving 351 respondents, limiting the generalisability of the findings. It examined public perceptions rather than children's actual learning outcomes. The questionnaire also did not explore respondents' reasoning or comprehensively assess their AI literacy. Furthermore, comparisons with previous studies were limited because they examined different learning outcomes. The reported demographic percentages should be checked against the original dataset before publication.

Future research should include more diverse samples, interviews with parents and teachers, and experimental or longitudinal studies involving children. These studies could compare AI-supported activities with traditional language-learning methods and assess vocabulary, pronunciation, listening comprehension, and speaking skills. Research in Uzbekistan would help identify approaches suited to local linguistic, cultural, and educational contexts.

Despite these limitations, the study provides an initial overview of public perceptions of AI in early language development. The contrast between uncertainty about AI before literacy acquisition and positive attitudes towards voice-based language learning offers a useful basis for further research.

CONCLUSION

The question of whether children should learn to use artificial intelligence before they can read and write does not have a simple or universal answer. The findings of this study suggest that respondents in Uzbekistan are generally familiar with ChatGPT but remain cautious about introducing AI before children acquire foundational literacy skills. Although 89.2% reported being very or somewhat familiar with ChatGPT, only 27% agreed or strongly agreed that AI could support language development before reading and writing. In contrast, 81.1% expressed positive views about voice-based AI for second-language learning, while 59.5% believed that children should be introduced to AI after the age of ten.

These findings reveal a distinction between general attitudes towards early AI use and perceptions of specific educational applications. Respondents appeared more receptive to voice-based AI when it was associated with a clearly defined learning activity, such as practising a second language. Nevertheless, these results represent perceptions rather than direct evidence of children's learning outcomes. They cannot establish whether AI improves language proficiency or determine the ideal age for its introduction.

AI literacy may become an important component of early education, but it should be understood as more than the ability to operate technological tools. Children also need age-appropriate opportunities to understand that AI can make mistakes, that its responses should not always be accepted without question, and that

reliable guidance from parents and teachers remains essential. Early AI education should therefore combine practical experience with basic critical awareness, responsible use, and appropriate adult supervision.

At the same time, foundational literacy skills must remain a priority. Learning to read and write requires active practice, meaningful communication, listening, storytelling, handwriting, and interaction with other people. AI may provide additional opportunities for language practice, but it should not replace these essential experiences or reduce children's opportunities to think, communicate, and learn independently.

For Uzbekistan, the findings point to the value of developing age-appropriate guidance for parents and educators and conducting further research into the educational effectiveness of voice-based AI. Future studies should involve children directly through carefully designed learning activities and assess measurable outcomes in vocabulary, pronunciation, listening comprehension, and speaking. Research should also examine how language background, age, and adult guidance influence learning.

Ultimately, the question should not be limited to when children ought to begin using AI. It should also address what children need to understand about AI, how these tools can support their developmental needs, and how their use can be balanced with independent learning and human interaction. A child-centred approach that treats AI as a supplementary resource, rather than a substitute for foundational skills and relationships, offers a more appropriate direction for its integration into early education.

References:

1. Ali, S., DiPaola, D., Lee, I., Sindato, V., Kim, G., Blumofe, R., & Breazeal, C. (2021). Children as creators, thinkers and citizens in an AI-driven future. *Computers and Education: Artificial Intelligence, 2*.

2. Bernstein, D., & Crowley, K. (2008). Searching for signs of intelligent life: An investigation of young children's beliefs about robot intelligence. *The Journal of the Learning Sciences, 17*(2), 225–247.

3. Ibaibarriaga, G., Acha, J., & Perea, M. (2025). The impact of handwriting and typing practice in children's letter and word learning: Implications for literacy development. *Journal of Experimental Child Psychology, 253*, Article 106195. https://doi.org/10.1016/j.jecp.2025.106195

4. Jia, F., et al. (2025). [Full bibliographic details should be verified against the original publication before submission.]

5. Ljungcrantz, L. (2026). The interaction of AI and early childhood education: A state-of-the-art review 2020–2024. *Early Childhood Education Journal, 54*, 3565–3581.

6. Madigan, S., McArthur, B. A., Anhorn, C., Eirich, R., & Christakis, D. A. (2020). Associations between screen use and child language skills: A systematic review and meta-analysis. *JAMA Pediatrics, 174*(7), 665–675. https://doi.org/10.1001/jamapediatrics.2020.0327

7. Nikolopoulou, K. (2025). Child-centered integration of generative AI in early learning: Balancing promises and challenges. *AI, Brain and Child, 1*, Article 21.

8. Picton, I., Lebsie, M., & Clark, C. (2026). *Parents' use of AI to support literacy at home in 2026*. National Literacy Trust.

9. Su, J., & Yang, W. (2024). Artificial intelligence and robotics for young children: Redeveloping the five big ideas framework. *ECNU Review of Education, 7*(3), 685–698. https://doi.org/10.1177/20965311231218013

10. UNESCO. (2023). *Guidance for generative AI in education and research*. https://gcedclearinghouse.org/en/node/129359

11. Xu, Y., Aubele, J., Vigil, V., Bustamante, A. S., Kim, Y.-S., & Warschauer, M. (2022). Dialogue with a conversational agent promotes children's story comprehension via enhancing engagement. *Child Development, 93*(2), e149–e167. https://doi.org/10.1111/cdev.13708

12. Güner, H., Er, E., Akçapınar, G., & Khalil, M. (2024). From chalkboards to AI-powered learning: Students' attitudes and perspectives on use of ChatGPT in educational settings. *Educational Technology & Society*, *27*(2), 386–404.