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Aladdin's Genie or Pandora's Box for Early Childhood Education? Experts Chat on the Roles, Challenges, and Developments of ChatGPT

Wenwei Luo[a], Huihua He[a], Jin Liu[b], Ilene R. Berson[c], Michael J. Berson[c], Yisu Zhou[d], and Hui Li[a,e]

[a]Shanghai Institute of Early Childhood Education, Shanghai Normal University; [b]College of Information Engineering, Shanghai Maritime University; [c]College of Education, University of South Florida; [d]Faculty of Education, University of Macau; [e]School of Education, Macquarie University

ABSTRACT

Research Findings: This study aims to explore the optimal roles, pressing challenges, and future developments of ChatGPT in early childhood education (ECE) by interviewing six expert professors from China and the United States. A content analysis approach that combined inductive and deductive coding was employed to analyze the transcribed interviews. The findings of this study revealed two primary roles of ChatGPT in ECE: (1) conversational agent for young children and (2) on-call facilitator for educators and caregivers. The challenges and risks associated with ChatGPT were categorized using the "3A2S" framework, which includes Accessibility, Affordability, Accountability, Sustainability, and Social Justice. The participants suggest that as knowledge, information retrieval, and integration skills become less critical, human agency and inquiry ability become more important. As a result, they predict that ChatGPT's future trajectory should be as a resource for Intelligence Augmentation (IA) rather than as a replacement for the actions of educators and caregivers. Furthermore, AI opens new domains in ECE, such as AI literacy and AI social interaction, paving the way for novel opportunities and challenges in the field. *Practice or Policy:* This study contributes to the ongoing discourse on integrating AI technologies in ECE and offers valuable suggestions for policymakers, educators, and caregivers.

The launch of ChatGPT in early 2023 changed the world overnight and dramatically provoked public interest and global concerns about the application of artificial intelligence (AI) in the education sector (Chen & Lin, 2023; Dwivedi et al., 2021; Su & Yang, 2023). This "ChatGPT Tsunami" has ignited our hope for better education assisted by AI and awakened our fear of its uncertain impact on teachers and learners. Optimists would underscore the fact that ChatGPT excels in tasks such as answering questions and composing text and demonstrates a powerful capacity for intelligent conversation in educational contexts (Dowling & Lucey, 2023; Mhlanga, 2023; Tate et al., 2023; Warr et al., 2023). This is because ChatGPT could thoroughly enhance human education by offering personalized and responsive AI support to learners and teachers (Atlas, 2023; Baidoo-Anu & Ansah, 2023; Opara et al., 2023) such as providing instant feedback, answering questions, and supplying resources (Opara et al., 2023), marking assignments, and planning lessons (Cooper, 2023; Kasneci et al., 2023). In contrast, pessimists tend to highlight its negative impacts on learning and teaching at all levels, such as the proliferation of false information and biased viewpoints, violations of academic integrity, loss of jobs, and further disparities in access that expand the digital divide (Communication

CONTACT Hui Li philip.li@shnu.edu.cn; philip.li@mq.edu.au Shanghai Institute of Early Childhood Education, Shanghai Normal University, Room 512, Jiaoyuan Building, 100 Guilin Road, Shanghai 200234, China

with Bing's ChatGPT 4, April 25, 2023). To inform the following steps, empirical evidence is necessary. This study draws on in-depth interviews with six experts to understand the optimal roles, pressing challenges, and future developments of ChatGPT in early childhood education.

The Benefits of Integrating ChatGPT in Education

ChatGPT presents tremendous opportunities in the field of education (Kasneci et al., 2023; Su & Yang, 2023; Yan, 2023) that could be seized and capitalized to facilitate learning and teaching, respectively. First, ChatGPT offers a wealth of opportunities for learning enhancement across all education levels, catering to unique individual preferences, abilities, and needs (Kasneci et al., 2023; Su & Yang, 2023). It may facilitate personalized learning experiences, supporting students in various aspects, such as developing reading, writing, and critical thinking skills (Atlas, 2023; Baidoo-Anu & Ansah, 2023; Opara et al., 2023). Its large language models (LLMs) can aid in developing reading and writing skills in primary school students; benefit secondary school students by tailoring practice problems, quizzes, and problem-solving exercises; and leverage university students with better research and writing tasks (Kasneci et al., 2023). Moreover, LLMs can empower learners with disabilities through speech-to-text and text-to-speech integrations, providing inclusive learning strategies with appropriate support (Kasneci et al., 2023). This has empowered ChatGPT to provide personalized support for students of different ages and backgrounds. As Mhlanga (2023) points out, ChatGPT can design educational plans and resources based on students' language levels and subject characteristics, offering tailored learning support. In addition, ChatGPT can adjust learning plans and course content according to students' learning history and performance, further assisting their learning journey (Qadir, 2022).

Second, ChatGPT also presents remarkable instruction opportunities, potentially revolutionizing teaching practices and pedagogic approaches (Opara et al., 2023). For instance, by enabling the creation of personalized learning experiences and tailored feedback, ChatGPT can alleviate teachers' burdens and provide timely guidance for students to better grasp concepts and skills (Rospigliosi, 2023). Additionally, LLMs can automatically create teaching materials such as exercises, presentations, and courseware, leading to increased efficiency in the teaching process (Rospigliosi, 2023). Furthermore, ChatGPT can also generate study notes and knowledge summaries, offering students a more comprehensive and diverse range of learning resources (Warr et al., 2023). Regarding assessment, ChatGPT can automatically evaluate student work and responses, providing feedback and suggestions that reduce teachers' workload (Opara et al., 2023). This real-time feedback and guidance not only help students grasp key concepts and skills more effectively but also enable teachers to focus on other aspects of instruction that require their expertise (Baidoo-Anu & Ansah, 2023). Overall, applying ChatGPT in teaching practices can lead to more efficient and effective educational experiences, strengthening teachers' capacity and professionalism when used responsibly and sensibly.

The Challenges of Integrating ChatGPT in Education

Applying ChatGPT will challenge educational settings in the following domains: ethical and social concerns, technical limitations and reliability, and human involvement and oversight. First, every adoption of new technology is accompanied by ethical and social concerns, and ChatGPT is no exception (Kasneci et al., 2023; Mhlanga, 2023). Recent studies have reported its ethical and social challenges in educational contexts (Berson & Berson, 2023; Halaweh, 2023; Su & Yang, 2023; Tate et al., 2023). The necessity for a significant amount of training data to ensure precise outputs (Yan, 2023) has brought about questions regarding the quality and inclusiveness of the data. This has resulted in ethical concerns regarding potential biases in the training data and their impact on the accuracy of the resulting outputs (Mhlanga, 2023; Su & Yang, 2023). In addition, many universities have expressed their concerns about plagiarism and academic integrity issues, as students might misuse these tools to complete assignments or assessments without fully understanding the concepts (Rudolph et al., 2023). Furthermore, accessibility and the digital divide pose a challenge, as not all

students may have equal access to advanced AI technology, exacerbating existing inequalities in education (Iskender, 2023; Kasneci et al., 2023).

Moreover, the technical limitations and reliability issues also present significant challenges for ChatGPT in education. Ensuring the accuracy and dependability of AI-generated responses is essential, particularly as ChatGPT may struggle to understand students' questions (Iskender, 2023) or may inadvertently learn incorrect information (Rudolph et al., 2023). Privacy and data security are also paramount, as sensitive student information must be safeguarded from potential breaches (Baidoo-Anu & Ansah, 2023). Additionally, the growing dependence on technology in education raises concerns about students' ability to develop problem-solving skills and critical thinking without over-reliance on AI assistance (Kasneci et al., 2023).

Last but not least, the need for continuous human involvement and oversight remains a critical challenge in implementing ChatGPT in educational settings. For instance, teachers must monitor and guide the AI tool to ensure it continuously learns and adapts to different subjects and educational scenarios (Iskender, 2023) while possessing sufficient language understanding and knowledge storage to handle various questions and situations (Kasneci et al., 2023). This emphasizes the importance of not replacing human educators with AI tools but instead integrating these technologies as a supplement to enhance and support the educational experience. The balanced and responsible use of ChatGPT and similar AI tools can lead to more effective and inclusive learning environments while mitigating potential drawbacks (Chen & Lin, 2023).

The Objectives of This Study

Currently, there is limited evidence about the roles and functions of ChatGPT in the education field, with most studies being conceptual and lacking empirical research. Among the few existing empirical studies, some have investigated its application in various subjects and grade levels. Although current ChatGPT studies, such as Cooper (2023) on science education and Atlas (2023) on higher education, have explored the application of LLMs from both student learning and educator teaching perspectives, there remains a scarcity of research on their use in early childhood education (ECE). However, prior research on AI integration in early childhood education has demonstrated its usefulness and potential benefits in various aspects (Chen & Lin, 2023; Su et al., 2023). AI enables tailored learning by utilizing algorithms that analyze each child's performance, capabilities, learning preferences, requirements, and pace, providing customized learning experiences that address the child's unique developmental needs (Devi et al., 2022; Su & Yang, 2022). Furthermore, AI facilitates individualized, interactive support through intelligent toys designed to recognize and respond to the child's speech or inquiries, fostering learning opportunities not available in conventional education (Kewalramani et al., 2021; Williams et al., 2019). AI also enhances access to a broader range of learning experiences, as AI-powered assistive technologies, such as speech-to-text, text-to-speech, and automatic speech recognition, offer educational support for children with special needs or learning difficulties (Chen & Lin, 2023; Slavuj et al., 2015). These findings imply that AI technologies, like ChatGPT, could be promising in the realm of early childhood education. In addition, ECE has unique characteristics compared to other age groups, including, but not limited to, the integration of learning content within a preschooler's daily life without clear subject boundaries; learning predominantly through play; and teaching encompassing not only formal schooling but also a significant portion of family education (Li & Chen, 2023). Exploring ChatGPT's potential in this distinct age group is undoubtedly a valuable avenue for further research. Therefore, this study is dedicated to exploring the optimal roles and functions of ChatGPT in ECE, addressing its associated challenges and risks, and anticipating its future development. In particular, the following research questions guided this study:

(1) What are the optimal roles and functions of ChatGPT in the ECE sector?
(2) What are the main challenges and risks of ChatGPT for ECE?
(3) What are the likely developmental trajectories for ChatGPT in ECE?

Methods

Expert Interview Method

A qualitative approach, the expert interview method, was employed to address the posed research questions in this study. The expert interview method is a widely adopted research technique and is capable of exploring or acquiring knowledge about specific areas of action (Döringer, 2021). This is because an expert possesses technical, procedural, and interpretive knowledge in a specialized field (Littig & Pöchhacker, 2014). Consequently, experts, as individuals engaged in the societal and political aspects of life, often possess unique insights into particular issues or events (Littig, 2011). Moreover, leveraging their expertise enables tackling fundamental challenges encountered in social science research (von Soest, 2023). Therefore, the present study interviewed renowned experts from diverse institutions, countries, and regions to explore the practical perspectives on ChatGPT and ECE development from various standpoints.

Participants

To ensure the selection of representative cases, this study employed a purposive sampling method (Suri, 2011) to choose participants who are education and technology professors working in China and the United States and have used ChatGPT for more than two months. Accordingly, a convenience sampling approach (Tracy, 2019) was utilized to select six experts (see Table 1) for individual interviews from four universities in China and USA by leveraging the researchers' interpersonal network. Expert participants were chosen based on their expertise in ECE and their knowledge of artificial intelligence, which facilitated a more comprehensive exploration of the intersectional role of ChatGPT in early childhood development. All six experts were informed of the purpose and nature of the study before the interview and voluntarily agreed to participate. Since the experts reside in various countries and regions, one-on-one online interviews were conducted with each of them at different times to accommodate their schedules. This approach not only ensured the diversity of perspectives but also allowed for a thorough examination of the potential and challenges of ChatGPT in the context of early childhood education.

Interview Protocol

This study conducted semi-structured interviews focusing on the overarching question: "How can the roles and functions of ChatGPT in early childhood education be optimized while addressing potential challenges, risks, and future developments to ensure its effectiveness?" The interview protocol was

Table 1. Basic information about the experts.

Name	Title	Research field	Location
Professor P	Dean & Chair Professor	Digital Transformation in Early Childhood Education; Educational Policy; Early Childhood Education; Curriculum Theory; Pragmatics; Psycholinguistics; Cognitive Psychology	Shanghai, China
Professor H	Vice Dean	Digital Parenting; Digital Pedagogy; Early Childhood Mathematics Education	Shanghai, China
Professor J	Secretary General	Computer Science and Technology; Communication and Information Engineering	Shanghai, China
Professor Y	Course Director	Sociology of Education; Education Policy; Teacher Education; Comparative Education	Macau, China
Professor I	Chair Professor	Technological Innovation in the Early Years; Global Child Advocacy; Visual Research Methods in Education; Digital Cybersecurity in Schools	Florida, United States
Professor M	Chair Professor	Social Studies Education; Civic Education; Technological Innovation; Digital Citizenship/Cybersecurity in Schools; Teacher Education	Florida, United States

emailed to each participant one week before the interview so they could be prepared for the interview. Then, the first author individually conducted web-based interviews using video conferencing software with six participants. These interviews ranged from 45 to 79 minutes, with an average length of 65 minutes.

Interviews with the four Chinese participants were conducted in their native language – Mandarin, while interviews with the two American participants were conducted in English. Following the interviews, all six conversations were recorded and transcribed verbatim. Since the participants and the authors were proficient in Mandarin and English, the initial coding process was carried out separately for each language, closely adhering to the data (van Nes et al., 2010). Subsequently, the Mandarin data were translated into English by four native Chinese speakers, and an external translator verified the translations to enhance rigor. This research received ethical approval from the first author's university, and all participants' names are pseudonyms to protect their identities.

Data Analysis

The research team employed a content analysis approach (Saldaña, 2021) to analyze the interview data, incorporating inductive and deductive coding methods. MAXQDA 2022 software was used to facilitate a four-phase data coding approach, enhancing the analysis process's accuracy and reliability. In the first phase, the authors thoroughly read and reread the text data to familiarize themselves with the content. During the second phase, key themes emerging from the data were identified, and the third phase involved highlighting representative units of information that best exemplified the identified themes. The fourth and final phase saw the authors generating, selecting, or grouping categories using similar codes derived from the text-based data. The first author completed the four-phase data coding and the second author went through the coding results thoroughly and independently. They discussed the discrepancies, refined the codes accordingly, confirmed the final version with 100% agreement, indicating a satisfactory inter-coder reliability.

Initially, the data were organized based on inductive analysis. In the interview, one participant adopted the "3A2S" (Accessibility, Affordability, Accountability, Sustainability, and Social Justice) framework (Xie & Li, 2020) to analyze the theme of ChatGPT's challenges in early childhood education. During the data analysis period, the first and second authors found that this framework fitted the theme perfectly. Therefore, the research team decided to employ the "3A2S" framework to deductively sort and align the codes accordingly. This comprehensive and rigorous approach to data analysis ensured that the research findings were grounded in empirical data while also making connections to frameworks (Mayring, 2014). Table 2 outlines the sorting and coding stages, showcasing the culmination of the coding process, which resulted in the final coding scheme based on an integration of inductive and deductive analyses (Saldaña, 2021).

A peer debriefing approach was employed to guarantee the reliability and credibility of the analysis of coding results (Creswell & Creswell, 2017; Lincoln & Guba, 1985). In addition, four scholars, including the two authors and two external researchers, collaborated to ensure the accuracy of the analysis and verify the translation into English. Subsequently, the last author conducted an inquiry audit (Creswell & Creswell, 2017) to provide an additional review, further confirming the trustworthiness of the results.

Findings and Discussion

In response to the three research questions, our study presents the findings based on expert opinions in a comprehensive manner, divided into three sections: (1) Multiple Roles and Functions; (2) Potential Challenges and Risks based on the "3A2S" framework; and (3) Perspectives on the Future: AI or IA?

Table 2. Coding scheme.

First level code	Second level code	Third level code
Multiple Roles and Functions	Conversational Agent to young children	Contextual language development
		Conversational social skills
	On-call Facilitator to Educators and Caregivers	Constantly on-call assistant for teachers
		Constantly at-the-ready consultant for parents
Potential Challenges and Risks based on "3A2S"	Accessibility	Access permission
		Young children's access
	Affordability	Business profitability
		User affordability
	Accountability	Human becomes filters
		Change in assessment
	Sustainability	Learning motivation
		Problem-solving range in limit
	Social justice	ChatGPT divide
		Ethical concerns
Perspectives on the Future: AI or IA?	Less important knowledge and skills	Factual knowledge.
		Basic information retrieval and integration skills
	More important knowledge and skills	Human agency
		Inquiry ability
	Opening of new domains	AI literacy
		AI social interaction
		Rebuilding digital ecology

The Multiple Roles and Functions of ChatGPT

This section delves into ChatGPT's roles and functions for young children and educators or caregivers, providing insights into its impact on early childhood education.

Conversational Agent for Young Children

All experts emphasized the role of ChatGPT in fostering contextual language development and enhancing conversational social skills for young children from various angles, acting as a conversational agent with several key functions.

To begin with, ChatGPT can provide age-appropriate conversations for young children. As Professor I mentioned, "ChatGPT can explain concepts or words to children in a way they can understand, adjusting explanations for different ages, such as a five-year-old, an eight-year-old, and a twelve-year-old." Meanwhile, ChatGPT can offer suitable conversation formats for young children. For instance, Professor M described how ChatGPT could create a story in the style of a famous children's author, like Dr. Seuss, to help a child overcome their fear of a first airplane trip.

Moreover, ChatGPT tirelessly answers children's questions, catering to their curiosity. As Professor P explained, "Children are natural questioners. Unlike parents or teachers who might become frustrated after answering numerous questions, ChatGPT never gets tired or annoyed. Instead, it greatly satisfies children's curiosity, encouraging their love for asking questions, especially with the development of voice-input interactions." In addition, as Professor H pointed out, "ChatGPT can provide children with necessary feedback and assistance anytime, anywhere. This real-time feedback is akin to having an adult (agent) by the child's side, ready to answer questions, engage in discussions, or even participate in debates at any moment."

Furthermore, ChatGPT contributes to the enhancement of conversational social skills. Through interactive conversations, children can learn social cues, etiquette, and empathy, which are essential for effective communication in real-life situations. As Professor I mentioned, "When discussing ChatGPT's role in social-emotional learning, we have seen opportunities to develop 'social stories.' These stories, generated by ChatGPT, help teach children social skills. Sometimes, we even use them to create individual storybooks for children, which serve as reminders for self-regulation development."

On-Call Facilitator for Educators and Caregivers

All experts emphasized the "facilitator" role of ChatGPT for educators and caregivers, noting that while ChatGPT serves as a conversational partner and agent for young children, it acts as a 24-hour on-call facilitator for early childhood educators and caregivers. For educators, such as teachers, ChatGPT functions as an intelligent assistant. For caregivers, like parents, it acts as a constantly at-the-ready consultant.

Constantly On-Call Assistant for Educators. For educators such as preschool teachers, experts discussed the various functions of ChatGPT as an intelligent assistant. One of the primary uses they highlighted was that ChatGPT can act as a helpful assistant that is always available to teachers. For example, ChatGPT can provide additional content knowledge to supplement teachers' knowledge. As Professor M mentioned:

> One of the biggest concerns I've had ever since I started is that my students (pre-service teachers) don't know much about content knowledge to teach children, like history or geography. So, I'd rather have them go to ChatGPT to help double-check what they're thinking instead of making up something on their own and getting it wrong. I'm not saying that ChatGPT is always right. But it might help them with their content knowledge.

Professor Y highlighted, "ChatGPT's three main features are automation, search, and human-computer interaction. However, the greatest innovation for school education in the short term is its ability to produce diverse content, as the biggest need for many early childhood teachers is knowledge." He further explained, "Teachers may have studied professional subjects but may lack in-depth knowledge to handle daily issues. ChatGPT can provide great convenience." He also emphasized the benefits of ChatGPT's speed in consolidating information, saying, "Its ability to generate content faster and create diverse content is impressive, something an individual teacher might struggle with." As Professor P succinctly put it:

> ChatGPT allows every early childhood teacher to stand on the shoulders of experts, turning each one into an expert themselves. You can ask it any question; although its knowledge is limited to 2021, it possesses a wealth of information on early childhood education up to that point.

Additionally, ChatGPT can help reduce daily workload and increase teaching efficiency. Professor P emphasized its role in assisting with lesson preparation, saying, "It can save teachers time by providing them with valuable resources and information." Professor I provided a detailed example of how ChatGPT can generate lists of common misconceptions for teachers to address, explaining that it can "save them time and allow them to focus more on planning their instruction." Then, ChatGPT can support teaching by generating new ideas and strategies. Professor Y suggested that it can "serve as a heuristic method for teachers in the classroom," while Professor M envisioned it playing a role in the form of a generative AI device like an Echo Dot, used under teacher supervision, asserting that it "could be a valuable addition to the classroom for classroom management and guidance." Professor I highlighted that ChatGPT could help teachers with predictive grouping, stating, "Imagine collecting data on students, and you want to identify those who enjoy soccer in a class of 20. ChatGPT can quickly analyze the data, allowing for preplanning and related activities. We haven't done enough experimentation with this yet." This suggests that there is considerable potential for further exploration of ChatGPT's assistance in teaching. In addition, ChatGPT can help with administrative tasks. Professor J mentioned how it can assist with mundane tasks like organizing and summarizing materials, stating, "It can help teachers keep track of their resources and make better use of them." Professor H noted that it can also help managerial staff with tasks such as generating notices and regulations, asserting that "ChatGPT can streamline many administrative processes."

Moreover, ChatGPT can help teachers provide personalized and individualized guidance to young children. For example, it can deliver tailored teaching based on a child's interests, as Professor I illustrated: "Suppose you met a little boy in class who was really excited about airplanes but had a hard time keeping their attention. ChatGPT can create an engaging airplane adventure story to help

teach the child self-control." Furthermore, ChatGPT can address the conversational needs of children from families with special requirements, such as multilingual households, and facilitate dialogue between homes and schools. As Professor M mentioned, "We find that ChatGPT allows teachers to translate content into home languages, making it more accessible, which is relevant in our context." Professor I also highlighted this potential, stating, "If a preschool class in Shanghai connects with a class in Florida, and a teacher wanted to teach the children to say 'good morning,' ChatGPT could be used to generate the phrases and language needed, working in a translational space."

Lastly, by relieving some of the pressures early childhood teachers face, ChatGPT enables them to devote more time to enhancing their soft skills. Professors I and M saw ChatGPT as an assistant that could help teachers focus on what really matters in their classrooms. Professor I explained how ChatGPT can allow teachers to spend more time considering differentiating learning, saying that "it frees up time for teachers to develop more effective learning strategies." Professor M likened it to having a teacher's assistant with "superpowers," adding that "it can help teachers manage their workload more effectively."

Constantly At-The-Ready Consultant for Caregivers. For caregivers such as parents, ChatGPT serves as a constantly available consultant, offering a personal touch for parents to support their children's learning at home. Professor H said, "ChatGPT can help parents support their children's learning at home by providing resources, answering questions, and offering guidance on various educational topics, fostering a supportive home learning environment."

ChatGPT can be a valuable tool in helping parents communicate with their young children, especially for those who may struggle with this task. As Professor I elaborated:

> There are many parents who struggle with talking to their kids, even though they may excel in their own professions. They might not know how to engage with their four or five-year-old child. ChatGPT, acting as an AI agent, can help facilitate conversations between parents and children, similar to how family counselors teach parents how to communicate with their kids. When used appropriately, it can be a powerful resource for parental training and fostering meaningful conversations between parents and children.

Professor P believed ChatGPT to be a valuable assistant for parents, providing expert advice at their fingertips. "ChatGPT offers on-demand expertise, giving parents answers to their questions, even if they may not be able to judge the authenticity of the responses." Professor P also suggested that caregivers could benefit from a guidebook of prompts for using ChatGPT with children aged zero to six.

In summary, whether it is helping children, teachers, or parents, ChatGPT essentially promotes a shift in the educational model, adapting to digital transformation and moving from the traditional "adult-child" binary structure to an "adult-child-AI" tripartite structure. This technology-empowered tripartite structure has the potential to enhance the effectiveness and efficiency of early childhood education.

The "3A2S" Challenges and Risks

As mentioned earlier, the potential challenges and risks of ChatGPT could be framed into the "3A2S" framework, which encompasses five key aspects.

Accessibility

Access Permission. Professors P, H, and J all mentioned the issue of access permission. Professor J pointed out that "the impact on China is relatively small for now because, for various reasons, we cannot use this product; we don't have access permission." Professor H added, "China is blocked as a whole, but some universities, regions, and countries have chosen to ban its use within certain scopes due to concerns about its effects on students' performance or other factors." Professor P further explained, "Because accessibility divides the world into two groups: those who can use ChatGPT and

those who cannot. Those who can are the successful group, while those who can't are the losers. Revolutionary technologies create this divide, and whether or not one can access them is a challenge and issue."

Young Children's Access. For those who can access the technology, experts shared concerns about young children using ChatGPT due to their age. To begin with, at its current stage, GPT requires precise input while young children are still developing their language skills. As Professor I explained:

> This is an interesting point concerning children, as we don't see ChatGPT as a technological tool that is necessarily appropriate for young children at this time. It is a language tool and resource that relies on the precision of the prompts you input, so you have to be quite skillful. Even adults sometimes struggle to communicate with ChatGPT to obtain the information they hope for. So, for children whose language might not be their best modality for communication, they are still developing their language skills.

Moreover, young children need to develop their imagination before using technology. Professor M asserted, "We all think that before children necessarily begin utilizing generative forms of artificial intelligence, like ChatGPT, they themselves should be having opportunities to learn how to develop their creative potential and their own sense of imagination." Additionally, young children should not become overly reliant on AI and should establish critical thinking skills. As Professor I explained, "We don't want children at a very young age to become overly trusting of the technology of the artificial intelligence. . . because young children don't yet have the capacity to do those things without guidance and support." Lastly, children may lack the background knowledge needed for high-quality interactions with ChatGPT. Professor M mentioned, "The more contextual knowledge you have, the better the responses you're going to have from ChatGPT, so there's an expectation."

In summary, the potential challenges and risks associated with ChatGPT's accessibility are multifaceted, particularly when considering its use among young children who are still developing their language skills and facing other obstacles.

Affordability

Business Profitability. It is essential to balance the costs associated with AI development and implementation with the need to maintain affordable access to AI tools for educational institutions and users. As Professor J explained:

> Technically, it is possible to achieve high computational power and fast response times. However, doing so would require a significant financial investment. The challenge for businesses is to strike a balance between the necessary computational power and the financial resources required to provide it. Therefore, it is fundamentally a question of affordability.

In this quote, Professor J highlighted the importance of considering affordability when dealing with the costs associated with AI development and implementation, emphasizing that businesses must find the right balance between investing in computational power and ensuring accessibility for users.

User Affordability. Ensuring that the cost of using ChatGPT does not create a barrier for schools, educators, and families who wish to integrate it into their early childhood education programs is essential. Professor P stated, "It is important to ensure that the cost of using ChatGPT does not create a barrier for schools, educators, and families." Similarly, Professor Y emphasized, "We need to consider the economic barriers that may prevent some families or schools from accessing AI tools and develop strategies to ensure that cost does not limit access to quality education."

Accountability

Human as Filters. Professor M emphasized the importance of human intervention and highlighted that, under the aspect of accountability, adults are the responsible parties for ChatGPT in ECE. He stated, "Human beings should be the filter for ChatGPT, particularly when it comes to young children." He explained that although children are born skeptics, the power of new

technologies like generative AI can make it difficult for them to maintain skepticism. Professor M emphasized the need for teachers to exercise common sense when using such tools and highlighted the importance of teaching children early on how to interact with these technologies appropriately.

ChatGPT is known for generating fabricated answers, fake references, and nonexistent names. Moreover, it has been criticized for generating biased and discriminatory content. Professor I expressed this concern, saying,

> One of the issues with ChatGPT and other generative AI is that they produce content that perpetuates certain biases and prejudices. These AI models learn from the content available on the Internet, which can be problematic due to the inherent biases and perspectives it contains. There is a need to find ways to safeguard children from such content and prevent its dissemination.

Professors J and Y both acknowledged that the issue of falsehood in ChatGPT-generated content could not be fundamentally resolved with recent technological innovations. Professor J explained,

> ChatGPT is a generative model, meaning that it predicts and generates answers based on the vast amounts of language data it has been trained on. It does not have a mechanism for checking the truthfulness or accuracy of its output, so it is not really a matter of whether it is fabricating information or not. To address the issue of veracity, another model would be needed to evaluate the authenticity and accuracy of ChatGPT's output, which is a separate task.

Both Professor J and Professor Y highlighted the limitations of ChatGPT's technology at this time. Professor Y elaborated, "There is a contradiction in the current state of technology where a language model must be both creative and precise in citing sources. It cannot achieve both simultaneously." To address these concerns, adults should progressively assist young children in devising tactics for determining when AI is being deceptive. Professor H emphasized this point, asserting, "It's vital for adults to mentor children in creating methods to detect AI-generated inaccuracies."

Change in Assessment. Regarding accountability in evaluating quality, ChatGPT has emerged as a critical factor in transforming the educational landscape. Considering the need for change in assessment due to ChatGPT's emergence, Professor I explained, "As the 'genie is out of the bottle,' we must recognize ChatGPT as a resource for students, just like calculators and the Internet, and adapt our educational contexts accordingly." The negative consequences of ChatGPT's emergence, such as students cheating or finding shortcuts, are concerns raised by Professor Y. However, Professor H suggested, "The appearance of negative issues, like students using ChatGPT for assignments and exams, should not cause excessive panic. On the contrary, the occurrence of such situations is an excellent opportunity for us to reflect on, improve evaluation methods, and strengthen educational management."

Experts believed there might be three potential strategies for addressing the changes in assessment methods brought about by ChatGPT. One approach, as described by Professor Y, is to completely isolate AI by returning to traditional pen-and-paper exams. Professor J concurred, asserting that "ChatGPT is like a very smart tutor, but it can't help you during the exam."

Another tactic entails concentrating on areas where current AI technology falls short, such as answering context-specific questions, as mentioned by Professor Y. Professor H also advocated for examining "human strengths through machine weaknesses." What is more, Professor P proposed a "reverse evaluation" approach. He suggested:

> I even had a whimsical idea to ban ChatGPT, like some universities or as if taming a ferocious beast. Some teachers worry about how to assess with ChatGPT, but if you ask me, I'd create an exam with a single question: 'Please ask ChatGPT three questions.' I don't need the answers; I just want you to present the questions and explain why you chose them. We could even base future assessments on ChatGPT's responses and ask students to consider what follow-up questions they should ask.

Lastly, Professor Y proposed a human-AI collaboration, where students interact with AI to answer questions and solve problems. He mentioned, "This method, somewhat similar to computerized testing, has been employed in the assessment field for quite some time."

While experts have yet to determine a definitive direction for the future of assessment reform, it is clear that from an accountability standpoint, the emergence of ChatGPT will expedite the transformation of the current assessment system, gradually shifting the focus from knowledge-based evaluation to a more comprehensive system.

Sustainability

Sustainability is an important aspect to consider when discussing ChatGPT. There are concerns about whether it can sustainably support all countries and regions. Professor P mentioned, "With our large population if ChatGPT were accessible to 1.4 billion people in China, its supercomputing capabilities might collapse due to overload." Sustainability also manifests in two other aspects: maintaining children's learning motivation and the boundaries of ChatGPT's problem-solving capabilities in early childhood education.

Learning Motivation Problem. Professor Y raised concerns about students losing motivation if they can easily find answers: "If students can easily find answers, their motivation to attend classes might be affected." He further explained that ChatGPT is a powerful summary machine for acquiring knowledge. Professor H agreed, stating, "ChatGPT's precise answers may diminish children's self-initiative and weaken their learning motivation."

However, Professor J had an opposing view, believing that the decline in learning enthusiasm is unrelated to ChatGPT. Instead, if properly guided, it may maintain and stimulate learning enthusiasm. He explained, "I personally think that with a good AI tutor, learning enthusiasm might not necessarily decrease. It depends on the teacher and their ability to provide engaging tasks and methods, which may even increase young children's learning motivation."

Problem-Solving Range in Limit. Regarding problem-solving depth, experts commented that ChatGPT's current content depth could provide a solid foundation but could not exceed that. As Professor P explained:

> It offers answers, ensuring teachers and some experts are on the similar level. This raises the baseline, elevating everyone to a higher normal level. However, it cannot excel, as surpassing the level of these individuals is not possible. AI brings benefits to early childhood curriculum, teaching, and teacher competence. When asked about enhancing preschool teachers' competence, ChatGPT delivers professional answers, but not highly creative or high-end. To attain a top expert level, creativity and distinctive insights are necessary. My perspectives differ from the mainstream, which is something ChatGPT can't achieve. It can guarantee a baseline but cannot excel. Dialectical thinking is another aspect, and though it's worth exploring, its limitations stem from its database. Reaching top expert level is impossible for it, but it can create, catch up, and learn, leading to rapid development.

From a sustainability perspective, the boundary of AI is that it can only assist humans and cannot replace them. For young children, AI should not directly impact them but can only operate through adult intermediaries. Technically, Professor J believed that technology would not be able to achieve full interactivity in the short term, nor could it replace direct interactions such as parent-child and teacher-child interactions. He stated:

> ChatGPT4 is multimodal but has limitations due to our innate human interactions. It's challenging for machines to learn and replicate human senses, as they perceive the world differently. Current models don't account for factors like hormones, making it difficult for them to mimic humans. Advancements in technology and understanding human cognition could help, but this generation of conversational robots isn't there yet. The next generation may achieve this, but the timeline is uncertain.

Regarding interactions between young children, Professor J said:

> It can simulate a peer, but a very dull, monotonous, and cold one. Even if it can say something that seems human-like, it lacks other interactions, only offering natural language exchanges. I think the impact on children's development is significant, and I strongly advise against using such robots for excessive communication with children. It's like putting a human child among wolves – it's not a good idea. AI can assist humans but cannot replace human work.

In summary, from a sustainable education perspective, ChatGPT is far from matching human intelligence and cannot compete with human teachers. On the one hand, human teachers possess irreplaceable qualities. Education is a long-term interactive process that necessitates enduring high-quality, sustainable interactions, with face-to-face conversations, emotional connections, and intellectual exchanges between teachers and students being indispensable. On the other hand, in terms of technological development, ChatGPT remains at a relatively low level. While the current ChatGPT can integrate knowledge in specific areas or aspects, providing a baseline guarantee, there is still considerable room for improvement in processing unstructured information intelligently. This aligns with experts' opinion that ChatGPT can "only guarantee a baseline but cannot excel."

Social Justice

ChatGpt Divide. Addressing social justice, Professor P highlighted the ChatGPT divide, saying, "Accessibility creates two groups: those who can use ChatGPT, the 'successful,' and those who cannot, the 'losers.' This divide raises concerns for social justice." Additionally, Professor P elaborated on the historical link between revolutions and class divisions, emphasizing that ChatGPT, a significant AI product, will lead to industrial shifts and new class divisions. He compared the divide to an apocalyptic Earth scenario, saying, "When the end comes, some can board 'spaceship ChatGPT' and leave Earth, while many cannot, facing a different fate." Professor J also observed, "Individuals who can use ChatGPT effectively and avoid its pitfalls may gain a competitive edge in knowledge acquisition, potentially learning faster and better."

Ethical Concerns. ChatGPT's ethical concerns also impact social justice. First, ChatGPT does not disclose its data sources. As Professor I mentioned, "One of the issues with ChatGPT is that it does not provide the sources from which it gathers information." This creates three problems: uncertainty about information accuracy, lack of credit to data providers, and automatic data collection on users, including children.

Professor M explained, "ChatGPT doesn't provide citations, so we can't check the correctness of the information or its source." Furthermore, Professor I added, "People's ideas and information are being used by ChatGPT without giving them credit, and they don't earn money for their creative content." This data collection on children also raises concerns, as Professor H noted, "It's unclear how ChatGPT stores and processes user interactions, leading to concerns about privacy, data security, and ethics." However, Professors M and I also mentioned that AI's data collection on students could help adults discover previously unnoticed issues and intervene promptly. Professor M said, "As data is collected on children, AI could guide individualized learning or interventions children might need." Professor I added, "AI can sometimes pick up potential delays in children's skill development before adults notice due to its ability to collect vast amounts of data over time."

Moreover, ChatGPT's ethics primarily reflect Western cultural values, raising questions about fairness for users in other regions. Professor Y said, "ChatGPT is ethically neutral, but its ethical guidelines are imposed by its trainers, mainly from the US or white populations, which may not be appropriate for other countries." Professor I also mentioned cultural distinctions between countries that could lead to limitations and concerns.

In conclusion, several participants emphasized that technology might act as a social accelerator, highlighting the importance of carefully utilizing it to reduce disparities and foster fairer social development rather than exacerbating existing gaps between individuals and communities.

Perspectives on the Future: AI (Artificial Intelligence) or IA (Intelligence Augmentation)?

Historically, the introduction of calculators sparked concerns about students' weakening computational abilities. However, in retrospect, calculators have revolutionized math education by making certain knowledge less critical (e.g., basic arithmetic), emphasizing other areas as more important (e.g., statistics), and opening up new knowledge domains (e.g., complex geometry). This perspective can be applied to ChatGPT as well.

Less Important Knowledge and Skills

In expert interviews, some knowledge and skills were thought to be important but turned out to be less significant. Professor M mentioned, "With the advent of ChatGPT, people aren't becoming more ignorant, but rather less willing to spend time and energy on lifeless, cold factual knowledge." Professor H added, "Some knowledge and skills may become relatively less important after the emergence of ChatGPT and other AI technologies, such as fact-finding, which involves using search engines to locate factual information, since AI can provide fast, accurate answers." Professor J noted, "Basic information retrieval and integration skills are also less important now, as the speed of acquiring information increases, making assessments of students' information retrieval skills less meaningful."

More Important Knowledge and Skills

Certain knowledge and skills, such as critical thinking, data literacy, creativity, lifelong learning, and interdisciplinary knowledge, have become more valuable. This study highlights two main points mentioned by nearly every expert:

Human Agency. The experts emphasized the importance of human decision-making and responsibility when using AI tools like ChatGPT to ensure that technology is used ethically and effectively in early childhood education. More importantly, they highlighted the emotional aspect of interactions with young children, whether in parent-child, teacher-child, or peer interactions. This emotional aspect is a crucial and irreplaceable part of human agency in early childhood, becoming increasingly important. As Professor I explained, "We should always prioritize early childhood relationships and ensure that AI technologies like ChatGPT are used to optimize and focus on our human interactions and engagement with children, rather than replacing them."

Inquiry Ability. As previously mentioned by Professor P, the reform in assessment methods may shift toward reverse questioning, making the ability to ask questions a vital skill. Professor I stated, "You know, everything is about the prompt; ChatGPT only responds based on the way you ask the question." Professor Y added, "ChatGPT's output depends on human prompts; it requires contextualized, need-specific input. Using varied commands elicits diverse responses, honing inquiry and description skills, and saving time." Professor H noted,

> Now, Prompt Engineering has become a hot new profession with annual salaries exceeding one million dollars. How to ask questions, how to provide concise instructions, and how to cooperate with AI like chatbots will become crucial skills that offer a significant advantage.

Professor P took it a step further, suggesting a shift from inquiry skills to planning skills:

> Or, going even further, one should develop planning abilities, contemplating the next scenario, analyzing, deconstructing, and then issuing commands to ChatGPT. This presents a challenge to a teacher's intellect and wisdom since our counterpart is ChatGPT, which is very smart. Thus, you need to improve your intelligence, analytical planning, and guidance abilities, as well as your ability to ask well-planned and analytical questions. In this way, you'll be able to ask excellent questions.

Opening of New Domains

AI Literacy. Experts like Professors P and I stressed the importance of AI literacy. Professor P introduced the concept of AI literacy, stating, "AI Literacy involves understanding AI, knowing how to interact with it, discerning when to seek its help, and importantly, recognizing when it's not needed, especially for interpersonal communication and emotional aspects." Professor I also emphasized its importance, "Really, what we're finding with ChatGPT is that it almost requires a different set of literacy skills." Professor P further suggested, "We must enhance AI literacy for young children, parents, and teachers alike. They must properly recognize and understand AI." This emphasis on AI literacy in early childhood education aligns with the findings of recent studies, such as Su et al. (2023) and Su and Yang (2023), which also highlight the importance of developing AI literacy in ECE settings. As the integration of AI technologies becomes more prevalent in education, fostering AI literacy should be considered a priority area for future research and practice.

Al Social Interaction. All experts mentioned the concept of AI social interaction and human-machine communication. The new generation must learn to communicate with robots. Professor Y said,

> I can show you a screenshot of my conversation with a chatbot. It can discuss philosophical questions like 'Why are we alive?' and 'Are you living in a matrix?' This is a human-machine interaction model. Our children may need to learn new ways to communicate with machines.

Professor M mentioned AI-embedded toys, saying,

> In the next few years, we'll see AI-embedded dolls and toys that interact with children, helping develop both cognitive and socioemotional skills. We might have AI-embedded dolls in classrooms, teaching socioemotional skills as an example. Over time, as costs go down, more AI-embedded toys, games, and activities will be found in unexpected places.

Professor P discussed AI social norms, saying, "With AI, we need to establish new AI ethics for interactions and social rules between humans and AI. Parents and teachers should cultivate AI ethics in children. We need to create a protocol of AI social norms."

Rebuilding Digital Ecology. The impact of ChatGPT on education can be divided into superficial and profound effects. This article mainly discusses the superficial impact, which revolves around the transformation of knowledge production. For example, ChatGPT assists with knowledge acquisition and information integration, leveraging its exceptional conversational and content generation capabilities. This can be applied to intelligent tutoring systems and teacher assistance to enhance the quality and efficiency of education.

However, the profound impact challenges the entire education system and is a more pressing issue for future discussions. For instance, as ChatGPT can replace many entry-level knowledge tasks, what knowledge and skills will future talents need? How should educational systems adapt regarding curriculum design, teaching methods, and course offerings? This is what Professor P referred to as "Rebuilding Digital Ecology."

In conclusion, Professor I stated, "It would be better to refer to ChatGPT as intelligence augmentation (IA), augmenting our human intelligence, as opposed to the technology becoming intelligent." AI can serve as an assistant to teachers, administrators, and parents but cannot replace human educators. AI can only act according to human-set objectives and obey human commands, replacing humans in knowledge management tasks. The initiation of these tasks comes from humans and can be stopped at any time according to human will. Therefore, it is a resource for Intelligence Augmentation (IA), not a replacement for educators' and caregivers' actions.

Limitations and Implications

This study has some limitations that should be considered when interpreting the findings. The first limitation is that the expert interviews were conducted between late March and early April, which

coincided with the release of GPT-4. As a result, the entire ChatGPT discussion was based on the ChatGPT Mar 23 Version and did not include any discussions about potential subsequent technological iterations. This limitation may affect the findings by not capturing the latest advancements in ChatGPT technology. The second limitation relates to the choice of the expert interview methodology. Although expert interviews are considered an effective empirical method for revealing internal practical knowledge (Bogner et al., 2009; Döringer, 2021; von Soest, 2023), a primary weakness of this approach is that the opinions expressed by the experts may not be neutral, leading to potential biases. Further research could strengthen these findings by incorporating more data sources to address these limitations. The third limitation of this study is the inherent subjectivity in qualitative data analysis. To address this, multiple researchers were involved in coding and analysis, followed by consensus-building. However, future research may consider methodological triangulation for greater trustworthiness.

Considering the implications of ChatGPT in early childhood education, it is crucial to provide valuable suggestions for policymakers, educators, and caregivers in the field to maximize the benefits and minimize the risks associated with this technology. First and foremost, policymakers, educators, and caregivers in the field should adopt an open-minded attitude and accurately recognize the value and risks of AI. Education is known for its unique challenges, and countless new issues arise whenever new technologies are introduced into educational practices. Facing the emerging contradictions brought by ChatGPT in teaching, it is crucial not to resort to simple and crude blocking measures. The relationship between humans and ChatGPT is not adversarial but rather one of mutual achievement. An open, rational, and positive attitude should be upheld in education. The Chinese proverb says, "The wise are good at utilizing things and tools." The future belongs to those who are open and skillful in using technology and tools. To facilitate this, educational institutions could provide training programs for educators to learn about AI applications, including ChatGPT, and their potential use in teaching practices. In addition, workshops and seminars could be organized for educators to share their experiences and best practices in implementing AI tools in the classroom.

Secondly, as educators, we should have complete confidence that AI will not replace teachers, especially early childhood educators. Education involves emotions, imagination, respect, and individuality. Many times, education does not require scientific precision but instead pursues humanistic ambiguity. For example, ChatGPT excels in solving problems like "1 coin +1 coin = 2 coins' but is powerless in answering whether '1 life +1 life can equal 2 lives." To illustrate this, schools can create curricula that emphasize the unique skills of educators, such as AI literacy and Al Social Interaction, while integrating AI as a complementary tool.

Thirdly, education cannot rely solely on the "input-output" approach to solve problems. As previously mentioned, the unique skills and qualities that early childhood educators bring to the classroom and children's experiences make teachers invaluable and irreplaceable. Nonetheless, AI does offer the benefit of an intelligence augmentation tool to further enhance instruction, and future development in the field of early childhood will be influenced by trends in human-technology collaboration. Early childhood educators who develop proficiency in utilizing AI technology and skillfully integrate it into their teaching practices will be able to unlock new levels of effectiveness and efficiency in their work. The benefits of AI in the field of early childhood education are numerous, and practitioners who embrace this technology will be well-positioned to help their students thrive in a rapidly evolving world.

Last but not least, to address the challenges and risks associated with ChatGPT in early childhood education, policymakers should consider the following integrated approach: Improve accessibility by focusing on the popularization and application of ChatGPT, especially in early childhood education, and develop related policies that ensure children of all age groups fully benefit from this technology. This includes strengthening support for children with special needs and reducing the technical barriers they face. We could ensure affordability by paying attention to the commercial sustainability and user affordability of ChatGPT in the education sector. We should also encourage companies to offer reasonably priced products and services and establish

funding programs to make the technology accessible to all families. We should strengthen accountability by establishing clear responsibility and obligation regulations, ensuring educators play a crucial role in using ChatGPT, such as acting as content filters and assessment reformers. In addition, we could encourage schools and educational institutions to establish enhanced assessment systems, ensuring students truly master knowledge and skills when using ChatGPT. In this way, we can maintain sustainability by focusing on the impact of ChatGPT on learning motivation and problem-solving ability and developing corresponding guidelines to ensure educators still prioritize students' active learning and critical thinking skills while using AI-assisted teaching. Socially, we should promote social equity by considering the impact of ChatGPT applications in education on social equity and developing policies to reduce the digital divide, ensuring all students enjoy the benefits of AI technology. Meanwhile, we should pay attention to related ethical issues and establish clear ethical and legal frameworks to guide and regulate the rational application of ChatGPT in education.

Conclusion: Aladdin's Genie or Pandora's Box?

Whether ChatGPT is a "magic lamp" or a "Pandora's box" for ECE depends on its implementation and the extent to which educators, caregivers, and other stakeholders consider the potential benefits, challenges, and risks. If used responsibly, ChatGPT could serve as a valuable tool to support learning and teaching processes. However, if not properly managed, it would pose ethical, social, and technical challenges. Therefore, striking a balance between leveraging its benefits and addressing potential concerns is crucial for maximizing the positive impact of ChatGPT on ECE. To optimists, it might be "Aladdin's Genie;" to pessimists, it could be "Pandora's Box." Angel or Demon? Depends on how you view and handle it.

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ORCID

Hui Li http://orcid.org/0000-0001-9355-1116

References

Atlas, S. (2023). *ChatGPT for higher education and professional development: A guide to conversational AI*. https://digitalcommons.uri.edu/cba_facpubs/548

Baidoo-Anu, D., & Ansah, L. O. (2023). Education in the era of generative artificial intelligence (AI): Understanding the potential benefits of ChatGPT in promoting teaching and learning. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.4337484

Berson, I. R., & Berson, M. J. (2023). The democratization of AI and its transformative potential in social studies education. *Social Education*, *87*(2), 114–118.

Bogner, A., Littig, B., & Menz, W. (2009). Introduction: Expert interviews — an introduction to a new methodological debate. In A. Bogner, B. Littig, & W. Menz (Eds.), *Interviewing experts* (pp. 1–13). Palgrave Macmillan UK. https://doi.org/10.1057/9780230244276_1

Chen, J. J., & Lin, J. C. (2023). Artificial intelligence as a double-edged sword: Wielding the POWER principles to maximize its positive effects and minimize its negative effects. *Contemporary Issues in Early Childhood*, 146394912311698. https://doi.org/10.1177/14639491231169813

Cooper, G. (2023). Examining science education in ChatGPT: An exploratory study of generative artificial intelligence. *Journal of Science Education and Technology*, *32*(3), 444–452. https://doi.org/10.1007/s10956-023-10039-y

Creswell, J. W., & Creswell, J. D. (2017). *Research design: Qualitative, quantitative, and mixed methods approaches*. SAGE Publications.

Devi, J. S., Sreedhar, M. B., Arulprakash, P., Kazi, K., & Radhakrishnan, R. (2022). A path towards child-centric artificial intelligence based education. *International Journal of Early Childhood*, *14*(3), 2022. https://doi.org/10.9756/INT-JECSE/V14I3.1145

Döringer, S. (2021). 'The problem-centred expert interview'. Combining qualitative interviewing approaches for investigating implicit expert knowledge. *International Journal of Social Research Methodology*, *24*(3), 265–278. https://doi.org/10.1080/13645579.2020.1766777

Dowling, M., & Lucey, B. (2023). ChatGPT for (Finance) research: The Bananarama conjecture. *Finance Research Letters*, *53*, 103662. https://doi.org/10.1016/j.frl.2023.103662

Dwivedi, Y. K., Hughes, L., Ismagilova, E., Aarts, G., Coombs, C., Crick, T., Duan, Y., Dwivedi, R., Edwards, J., Eirug, A., Galanos, V., Ilavarasan, P. V., Janssen, M., Jones, P., Kar, A. K., Kizgin, H., Kronemann, B., Lal, B., Lucini, B., … Williams, M. D. (2021). Artificial Intelligence (AI): Multidisciplinary perspectives on emerging challenges, opportunities, and agenda for research, practice and policy. *International Journal of Information Management*, *57*, 101994. https://doi.org/10.1016/j.ijinfomgt.2019.08.002

Halaweh, M. (2023). ChatGPT in education: Strategies for responsible implementation. *Contemporary Educational Technology*, *15*(2), ep421. https://doi.org/10.30935/cedtech/13036

Iskender, A. (2023). Holy or unholy? Interview with open AI's ChatGPT. *European Journal of Tourism Research*, *34*, 3414. https://doi.org/10.54055/ejtr.v34i.3169

Kasneci, E., Sessler, K., Küchemann, S., Bannert, M., Dementieva, D., Fischer, F., Gasser, U., Groh, G., Günnemann, S., Hüllermeier, E., Krusche, S., Kutyniok, G., Michaeli, T., Nerdel, C., Pfeffer, J., Poquet, O., Sailer, M., Schmidt, A., Seidel, T., … Kasneci, G. (2023). ChatGPT for good? On opportunities and challenges of large language models for education. *Learning & Individual Differences*, *103*, 102274. https://doi.org/10.1016/j.lindif.2023.102274

Kewalramani, S., Kidman, G., & Palaiologou, I. (2021). Using Artificial Intelligence (AI)-interfaced robotic toys in early childhood settings: A case for children's inquiry literacy. *European Early Childhood Education Research Journal*, *29* (5), 652–668. https://doi.org/10.1080/1350293X.2021.1968458

Li, P. H., & Chen, J.J. -L. (2023). *The glocalization of early childhood curriculum: Global childhoods, local curricula*. Routledge.

Lincoln, Y. S., & Guba, E. G. (1985). *Naturalistic inquiry*. SAGE Publications.

Littig, B. (2011). Expert interviews. In B. Badie, D. Berg-Schlosser, & L. Morlino (Eds.), *International encyclopedia of political science* (Vol. 5, pp. 1343–1346). Sage. https://irihs.ihs.ac.at/id/eprint/2443/

Littig, B., & Pöchhacker, F. (2014). Socio-translational collaboration in qualitative inquiry: The case of expert interviews. *Qualitative Inquiry*, *20*(9), 1085–1095. https://doi.org/10.1177/1077800414543696

Mayring, P. (2014). *Qualitative content analysis: Theoretical foundation, basic procedures and software solution*. SAGE Publications.

Mhlanga, D. (2023). Open AI in education, the responsible and ethical use of ChatGPT towards lifelong learning. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.4354422

Opara, E., Theresa, A.M. -E., & Aduke, T. C. (2023). ChatGPT for teaching, learning and research: Prospects and challenges. *Global Academic Journal of Humanities and Social Sciences*, *5*(2), 33–40. https://doi.org/10.36348/gajhss.2023.v05i02.001

Qadir, J. (2022). Engineering education in the era of ChatGPT: Promise and pitfalls of generative AI for education. *TechRxiv*. Preprint. https://doi.org/10.36227/techrxiv.21789434.v1.

Rospigliosi, P. A. (2023). Artificial intelligence in teaching and learning: What questions should we ask of ChatGPT? *Interactive Learning Environments*, *31*(1), 1–3.

Rudolph, J., Tan, S., & Tan, S. (2023). ChatGPT: Bullshit spewer or the end of traditional assessments in higher education? *Journal of Applied Learning & Teaching*, *6*(1). https://doi.org/10.37074/jalt.2023.6.1.9

Saldaña, J. (2021). *The coding manual for qualitative researchers* (4th ed.). SAGE Publications.

Slavuj, V., Kovačić, B., & Jugo, I. (2015). Intelligent tutoring systems for language learning. *2015 38th International Convention on Information and Communication Technology, Electronics and Microelectronics (MIPRO)* (pp. 814–819). https://doi.org/10.1109/MIPRO.2015.7160383

Su, J., Ng, D., & Chu, S. (2023). Artificial Intelligence (AI) literacy in early childhood education: The challenges and opportunities. *Computers and Education: Artificial Intelligence*, *4*, 100124. https://doi.org/10.1016/j.caeai.2023.100124

Suri, H. (2011). Purposeful sampling in qualitative research synthesis. *Qualitative Research Journal*, *11*(2), 63–75. https://doi.org/10.3316/QRJ1102063

Su, J., & Yang, W. (2022). Artificial intelligence in early childhood education: A scoping review. *Computers and Education: Artificial Intelligence*, *3*, 100049. https://doi.org/10.1016/j.caeai.2022.100049

Su, J., & Yang, W. (2023). Unlocking the power of ChatGPT: A framework for applying generative AI in education. *ECNU Review of Education*. https://doi.org/10.1177/20965311231168423

Tate, T., Doroudi, S., Ritchie, D., Xu, Y., & Uci, M. W. (2023). Educational research and AI-generated writing: Confronting the coming tsunami. *Edarxiv*. Preprint. https://doi.org/10.35542/osf.io/4mec3

Tracy, S. J. (2019). *Qualitative research methods: Collecting evidence, crafting analysis, communicating impact*. John Wiley & Sons.

van Nes, F., Abma, T., Jonsson, H., & Deeg, D. (2010). Language differences in qualitative research: Is meaning lost in translation? *European Journal of Ageing*, *7*(4), 313–316. https://doi.org/10.1007/s10433-010-0168-y

von Soest, C. (2023). Why do we speak to experts? Reviving the strength of the expert interview method. *Perspectives on Politics*, *21*(1), 277–287. https://doi.org/10.1017/S1537592722001116

Warr, M., Mishra, P., Henriksen, D., & Woo, L. J. (2023). A chat about GPT3 (and other forms of alien intelligence) with Chris Dede. *TechTrends*. https://doi.org/10.1007/s11528-023-00843-z

Williams, R., Park, H. W., Oh, L., & Breazeal, C. (2019). Popbots: Designing an artificial intelligence curriculum for early childhood education. *Proceedings of the AAAI Conference on Artificial Intelligence*, *33*(1), 9729–9736. https://doi.org/10.1609/aaai.v33i01.33019729

Xie, S., & Li, H. (2020). Accessibility, affordability, accountability, sustainability and social justice of early childhood education in China: A case study of Shenzhen. *Children & Youth Services Review*, *118*, 118. https://doi.org/10.1016/j.childyouth.2020.105359

Yan, D. (2023). Impact of ChatGPT on learners in a L2 writing practicum: An exploratory investigation. *Education and Information Technologies*. https://doi.org/10.1007/s10639-023-11742-4