



Children, Rights and Algorithms in the Age of Generative AI

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Abstract: If Generative Artificial Intelligence (GAI) is to define the future of education, it is essential that children are at the center of its design and development. Equity, sustainability and social justice must be essential operating principles at every stage of the AI lifecycle, not mere aspirations. Children should not be treated as invisible users, but recognized as rights holders whose protection must be reflected in every line of code, every design decision and every public policy of the digital ecosystem. Achieving this goal requires ethical and practical commitment from educators, technology developers and governments. Educational equity, child protection and social justice must be translated into concrete, achievable and measurable goals, ensuring that AI contributes to a safe, inclusive and child-center educational environment.

Childhood in the Age of Generative AI

We live in an age where algorithms not only organize information, but also influence children's education, development, and emotional experiences. Generative AI has a remarkable ability to create interactive text, images, videos, and simulations, and is rapidly being integrated into the apps and platforms that children use every day. However, while this technology is advancing at a rapid pace, child protection, equity, and social justice seem to be advancing at a slower pace.

Childhood has historically been ignored in the design of digital technologies. From the creation of the Internet to the explosion of social media, everything has been conceived with adults in mind, leaving children in the background. Most ethical guidelines and national strategies on AI only make general references, without delving into the specific needs of children (Fosch-Villaronga et al., 2023). As a result, we have created a digital ecosystem where children are not only users, but also objects of data collection, subject to manipulation, and victims of unequal power dynamics. Artificial intelligence, being a technology created by humans, reflects the values and beliefs of those who develop and use it (Williams et al., 2019). However, these principles are not always self-evident, nor do they guarantee that its application is ethical or equitable for all people (UNESCO, 2021). The arrival of ChatGPT has transformed the relationship between technology and education, marking a milestone in the democratization of generative AI. This advancement allows anyone with internet access to use advanced language models, making tools that were previously only available to companies and institutions with significant resources more accessible (Su and Yang, 2023; Lo, 2023). This accessibility has favored educational inclusion, facilitating more equitable, affordable, and everyday learning for children (Chen and Lin, 2023).

Generative AI plays a key role in early childhood education, especially in achieving the Sustainable Development Goals, particularly SDG 4, which promotes inclusive, equitable and quality education (UN, 2022). Its ability to

personalize content and meet the learning needs of diverse child profiles makes it an essential tool (Chen et al., 2019). Giannini (2023) and Jeon and Lee (2023) highlight that AI not only optimizes teaching but also strengthens the teacher-student relationship, especially in early literacy (Yang, 2022). Furthermore, it enables the creation of personalized content and automated educational resources (Dijkstra et al., 2022). Large-scale language models (LLMs) contribute to this transformation by generating texts, images and simulations, transforming children's learning (Williams et al., 2019).

It is this field of development calls for further research to more fully understand the uses, risks, and opportunities that generative AI represents in children's lives (Wang et al., 2022; Wang et al., 2023). The rise of generative AI raises both expectations and fears in early childhood education (Yang, 2022; Su and Yang, 2022, 2023). Optimists praise its ability to personalize education and improve accessibility (Yang, 2022), while critics warn of bias and access to inappropriate content (Su and Yang, 2022, 2023). This duality has led to AI in early childhood education being described as a “double-edged sword” (Chen and Lin, 2023). The arrival of generative AI has amplified these risks, but it has also opened an unprecedented opportunity to transform the relationship between children and technology.

Practical Implications and Regulatory Needs

The literature shows a considerable difference between general regulatory frameworks for AI and those specifically designed to safeguard children. Although child-center AI is still in development, current initiatives are directed towards creating AI that is safe, ethical and responsive to children’s cognitive, emotional and social needs (Wang et al. 2023). Despite legislative diversity arising from socio-cultural contexts and national priorities, there is a global trend towards the creation of common regulatory frameworks for international digital platforms. These international documents and frameworks promote standards of privacy, fairness, security, transparency and responsible use of AI in child contexts. However, as Zimmerman et al. (2023) point out, the lack of integration of AI principles in key areas such as privacy, despite having clear and consistent regulations, allows some technology companies to evade their ethical responsibility, especially in protecting children's rights.

We find that, although the potential of generative AI is transformative, it also presents significant challenges: 1. Reproduction of biases and prejudices (Fjeld et al., 2020; Navigli et al., 2003), 2. Emotional manipulation, 3. Privacy and data protection risks, 4. Lack of legal accountability (Hooper, Livingstone, & Pothong, 2002). Henderson et al. (2023) underline the urgent need for regulations that force developers to take responsibility for harm caused by their algorithms. Only Through strong international cooperation, a safe, inclusive and fair digital environment can be created for all children (Mahomed et al. 2023). The regulation of generative AI in early childhood education should be aligned with the Convention on the Rights of the Child (CRC) and the Universal Declaration of Human Rights (UDHR). The UDHR, through its Article 25, underlines the importance of providing special protection to children, guaranteeing the safeguarding of their rights in physical and digital environments (Firmino Pinto, 2024). The CRC sets out key rights that must be considered in the use of AI in children’s education. These include the right to participation (art. 12), which allows children to have a say in the use of platforms and the management of their data; the right to privacy (art. 16),

which requires the protection of personal data and parental or guardian control over this information; and the right to protection from exploitation (arts. 19, 34 and 36), which prohibits exposing children to risks of abuse, exploitation or inappropriate content, requiring the adoption of appropriate protection policies.

Promoting free and accessible access to generative AI tools contributes to reducing the digital divide, moving towards social justice in education. Personalizing learning and adapting content to the individual needs of students strengthens educational equity. Equity, sustainability and social justice should be guiding principles in the implementation of generative AI and not just idealistic aspirations. However, deep learning algorithms, when based on historical data, can reproduce gender, race or class biases, as evidenced by cases of discrimination on AI platforms (Wang et al., 2022). The risks of generative AI go beyond reproducing biases, including emotional manipulation. Advanced virtual assistants and chatbots can influence the thoughts and emotions of children, who lack the cognitive maturity to withstand these impacts. Stuart Russell warns that algorithms can modify user behavior, increasing their vulnerability to future marketing strategies (Pomeroy, 2022).

Another critical challenge is the mass collection of children's personal and biometric data. Without proper regulation, generative AI applications can capture images, videos and other sensitive data, putting children's privacy and safety at risk. These risks underscore the need for strict controls to protect children in digital environments. Fjeld et al. (2020) point out the gap between theoretical principles and their practical application, highlighting the need to translate regulatory frameworks into effective actions to safeguard children's rights. Establishing legal accountability mechanisms is essential to protect children from the risks of generative AI. The absence of a clear definition of this responsibility allows companies to evade oversight, leaving children in a situation of legal vulnerability (Henderson et al., 2023). The Council of Europe warns about the dangers of AI in education, highlighting its potential negative impacts on human rights, democracy and the rule of law (Holmes et al., 2022).

UNICEF's Policy Guidance states that platforms and systems must comply with ethical standards that ensure child protection. Equity and social justice in AI for children require active participation of children and families in decisions about their privacy and safety. AI literacy is presented as a key tool to empower children and families to defend their rights online. The development of safe, ethical technologies adapted to the cognitive, emotional and social needs of children is promoted. Dahl et al. (2024) warn about the risks of implementing immature technologies in critical environments, recommending prior impact assessments.

To achieve equitable generative AI, the global adoption of Age-Appropriate Design Codes (AADC) is proposed, which in the UK have proven effective in protecting children. The UK ICO (2023) calls on AI developers to ensure universal protection of users, regardless of their age. Cross-sectoral cooperation is also presented as an essential pillar, with companies such as Amazon, CivitAI and Stability AI signing child safety commitments. Organizations such as Thorn and All Tech Is Human demonstrate the feasibility of an industry commitment to protect children in digital environments. Samia Firmino Pinto (2024) proposes an ethical framework for generative AI, based on the CDN, AADC and the UNICEF Policy Guide. This framework includes a) child-centered design, for the well-being, development

and active participation of children; b) transparency and explainability, which allow children and their families to understand and control automated decisions; c) data privacy and security, with minimal collection and protection of personal information; d) universal accessibility and social justice, ensuring equal access to platforms for all children. In this context, the 3A2S Framework, developed by Luo et al. (2024) and Xie and Li (2020), addresses five key dimensions of AI in early childhood education: Accessibility, Affordability, Accountability, Sustainability and Social Justice.

An Ecosystem of Shared Responsibility

We can conclude by saying that the arrival of generative AI in early childhood education must be preceded by critical awareness and vigorous action. It is not only about discovering and maximizing the possibilities that this technology offers us, but at the same time we must demand that these tools help protect children, enabling them to organize and use them critically. This is the time to act from the idea of responsibility and ethics, to work so that generative AI can transform education, but always in a way that is equitable, safe and respectful of children's rights. Ethical considerations in AI for early childhood education are not optional, but a fundamental requirement to ensure that these technologies respect the unique rights and needs of children.

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