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How Artificial Intelligence is Transforming Digital Tools for Child and Educational Psychology

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Abstract. The integration of artificial intelligence (AI) into digital tools for child and educational psychology represents a paradigm shift in how psychological support and educational interventions are delivered to young populations. This article examines the transformative role of AI technologies—including generative AI, conversational agents, emotion recognition systems, and adaptive learning platforms—in reshaping assessment, intervention, and engagement strategies for children and adolescents. Drawing on recent empirical research, the paper analyzes key opportunities such as personalized learning pathways, scalable mental health support, and real-time emotional monitoring, while critically examining challenges including data privacy concerns, algorithmic bias, developmental risks, and the necessity of human oversight. The analysis highlights the importance of co-design methodologies that actively involve children, parents, and clinicians in technology development, as well as the need for robust ethical frameworks to govern AI deployment in sensitive developmental contexts. The article concludes that while AI holds transformative potential for child and educational psychology, realizing this potential requires balancing technological innovation with safeguarding children's developmental needs and psychological well-being.

Keywords: artificial intelligence, educational psychology, child mental health, digital tools, generative AI, co-design, ethics.

1. Introduction

The convergence of artificial intelligence and child development science marks one of the most significant technological shifts in educational and psychological practice of the twenty-first century. Over the past decade, rapid advancements in machine learning, natural language processing, and affective computing have driven the development and adoption of AI-powered digital tools in educational settings. These technologies have evolved from experimental prototypes to large-scale deployments that now profoundly impact how children learn, interact, and receive psychological support.

The launch of ChatGPT in late 2022 served as a watershed

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moment, accelerating interest in generative AI applications for education and mental health . Built on deep learning and natural language processing technologies, generative AI tools are capable of producing diverse content based on user inputs, enabling unprecedented levels of personalization and interactivity in educational and therapeutic contexts . Alongside these developments, specialized AI applications have emerged, including conversational agents for mental health support, emotion recognition systems for detecting learner affect, and adaptive learning platforms that tailor instruction to individual cognitive profiles .

The relevance of AI to child and educational psychology extends beyond mere technological novelty. Traditional models of educational support and mental health care often prove inadequate for meeting the needs of children and young people due to barriers such as stigma, resource limitations, and geographical inaccessibility . Digital mental health interventions, particularly those leveraging AI, offer a promising adjunct to traditional services, leveraging technology to deliver scalable, personalized, and potentially more accessible care . Similarly, in educational contexts, AI systems can provide the kind of individualized attention that has long been recognized as optimal for learning but has remained impractical to deliver at scale through traditional means .

However, the integration of AI into child-centered domains raises profound questions about safety, ethics, and developmental appropriateness. Children constitute a particularly vulnerable population, and interactions with AI systems—especially those framed as emotional supporters, romantic partners, or close friends—could shape adolescents' social and emotional development in ways that remain poorly understood . Recent tragic cases, including the suicides of adolescents after prolonged conversations with AI companions, underscore the urgent need for appropriate safeguards and ethical frameworks .

This article provides a comprehensive examination of how AI technologies are transforming digital tools for child and educational psychology. It analyzes the key opportunities presented by AI-driven personalization, conversational agents, and emotion recognition systems, while critically examining the challenges and risks that must be addressed. The analysis emphasizes the importance of co-design methodologies and stakeholder engagement in developing safe

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and effective AI tools for young users.

2. AI Technologies in Child and Educational Psychology

2.1. Conversational Agents and AI Companions

Conversational agents represent one of the most prominent applications of AI in child and educational psychology. These systems use natural language processing to simulate human-like dialogue, enabling interactions that range from therapeutic conversations to educational tutoring. Generative AI has significantly enhanced the capabilities of these agents, allowing them to engage in open-ended conversations, adapt to user inputs in real time, and simulate therapeutic interactions.

In mental health contexts, conversational agents have been deployed to support children and young people with conditions including anxiety, depression, and emotion regulation difficulties. These systems provide scalable and accessible ways to deliver psychological support to diverse populations. For example, chatbots have been developed to teach life skills to adolescents through engaging dialogues and multimedia features, while WhatsApp-based chatbots have been co-designed to collect real-time longitudinal data on adolescent mood fluctuations. Some systems integrate "curious questioning" techniques inspired by therapeutic approaches to foster user engagement and support emotional exploration.

The rise of AI companions represents an evolution beyond task-oriented chatbots. AI companions are digital characters created to form emotional attachments and simulate relationships with users for companionship, entertainment, and romance. Recent survey research indicates that AI companions have become a significant part of many teenagers' digital lives, with 72% of US teens having used AI companions and more than half reporting regular engagement. Nearly one-third of teens turn to these AI characters for social interaction or emotional connection, including romantic exploration.

While these applications offer potential benefits—such as providing safe spaces for practicing social interactions and rehearsing real-life relationships—they also raise significant concerns. Researchers have identified risks including sexual harassment, emotional dependence, and blurred boundaries between reality and simulation. The developmental vulnerability of youth means that interactions with AI framed as emotional supporters or close friends could

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shape adolescents' social and emotional development in ways that may be detrimental .

2.2. Emotion Recognition and Affect-Aware Systems

Emotion recognition technologies represent another frontier in AI applications for child psychology. These systems detect and respond to students' affective states in real time using facial expression analysis, voice tone, keystroke patterns, or physiological signals . The integration of such affect-aware systems holds considerable potential to increase student engagement, motivation, and satisfaction by offering a more empathetic and responsive learning environment .

Research has demonstrated positive correlations between AI-driven emotion recognition and student engagement, while also suggesting that these technologies can reduce digital learning anxiety . This finding is consistent with the theoretical predictions of the Control-Value Theory of Achievement Emotions, which posits that learners' emotions arise from their perceptions of control over learning activities and the value they assign to those tasks .

However, the deployment of emotion recognition technologies introduces significant ethical complexities. The presence of constant emotional monitoring raises questions about student privacy, consent, and the potential for unintended emotional manipulation or stress . For many students, particularly those learning English as a foreign language, digital learning anxiety may stem from unfamiliarity with AI tools, fear of constant surveillance, and cognitive overload associated with complex digital interfaces .

2.3. Adaptive Learning and Personalization Systems

AI-driven personalization systems analyze learners' behaviors, preferences, and performance data to deliver customized content and learning pathways . These systems promise to make education more accessible and responsive to diverse learner needs, particularly in large-scale online environments where traditional one-size-fits-all approaches often fall short . The technical foundations of these systems include natural language processing models for understanding student inputs, reinforcement learning engines for determining optimal sequences of learning tasks, and knowledge tracing models for tracking student mastery .

Personalized tutoring through AI has been linked to improved learning outcomes, but challenges remain. As Laak,

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Abdelghani, and Aru observe, "personalisation is not guaranteed" . The effectiveness of personalization depends on the quality of the underlying algorithms, the appropriateness of the learning content, and the alignment with pedagogical goals . Furthermore, the opacity of many AI systems poses challenges for teachers who require interpretable insights into student learning progress .

3. Theoretical Frameworks and Empirical Evidence

The integration of AI into child and educational psychology is informed by several theoretical frameworks that help explain how and why these technologies influence learning and development.

3.1. Control-Value Theory of Achievement Emotions

Control-Value Theory provides a framework for understanding how AI technologies affect learner emotions and engagement. According to this theory, learners' emotions arise from their perceptions of control over learning activities and the value they assign to those tasks . When learners feel in control and perceive tasks as meaningful, they are more likely to experience positive emotions and remain engaged. AI-driven personalization enhances perceived control by aligning instruction with individual learner needs, while emotion recognition tools may increase task value by creating a responsive and emotionally supportive environment .

Empirical research supports these theoretical predictions. A study of Chinese EFL learners found that AI-driven personalization and emotion recognition were positively correlated with engagement and negatively correlated with digital learning anxiety . The study also demonstrated that anxiety partially mediated the relationship between AI technologies and engagement, suggesting that the emotional impact of AI systems plays a significant role in determining their effectiveness .

3.2. Social Constructivist Theory and Scaffolding

Social Constructivist Theory, particularly Vygotsky's concept of the Zone of Proximal Development, provides another important framework for understanding AI applications in education. According to this theory, learning is facilitated through social interaction and scaffolding within a learner's zone of proximal development. Chatbots and AI tutors can serve as always-available scaffolding agents, guiding learners through complex tasks, offering hints, and providing explanations .

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This theoretical grounding has been empirically validated. Research has shown that chatbots provide pedagogical affordances that are directly antithetical to the drivers of technological resistance, including 24/7 availability, self-paced interaction, immediate and personalized feedback, and a low-stakes, private practice environment. A randomized controlled trial demonstrated that chatbot-based interventions significantly reduced student resistance to technological change compared to traditional teaching methods, with a large effect size.

3.3. Co-Design and Stakeholder Engagement

Co-design methodologies actively engage end users—including children, parents or caregivers, and professionals—to ensure that interventions are safe, relevant, and aligned with user experiences and needs. All studies included in a recent systematic review of generative AI for youth mental health employed co-design methods, engaging young people as both end-users and co-creators who shaped app content, visual design, and functional features.

The outcomes of co-design efforts have been positive. Studies report high levels of user satisfaction, with participants appreciating how their input shaped the final products. Co-design has resulted in AI-enhanced tools perceived as more usable, engaging, and clinically effective. Creative approaches to co-design have included partnerships with organizations like UNICEF and technology developers to enhance scalability and ensure cultural relevance, as well as incorporating AI learning into co-design to enable chatbots to adapt in real-time based on user input.

4. Challenges and Ethical Considerations

4.1. Safety and Developmental Risks

The deployment of AI systems in child and educational contexts raises significant safety and developmental concerns. Research on youth interactions with AI companions has identified risks including grooming-like language, leading youth into romantic or emotional interactions, and modeling harmful values or norms. Stakeholder assessments of these risks are contextual, attending to factors such as youth maturity, AI character age, and how AI characters model values and norms.

Parents and developmental experts assess risks through different logics. Parents tend to take an event-based approach, flagging interactions as high risk when a single concerning element appears—for example, a mention of suicide

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or flirtation . Experts, by contrast, emphasize patterns over time, focusing on frequency and duration as indicators of escalating concern . These different logics have implications for the design of risk detection systems and interventions.

4.2. Privacy and Data Protection

Privacy concerns are paramount in AI applications for children. The collection and analysis of sensitive data—including emotional states, behavioral patterns, and mental health information—require robust protections. Differential privacy, which adds controlled noise to data or gradients to prevent individual student records from being decoded, and federated learning, which allows training on local servers without centralizing raw student data, represent promising technical approaches .

However, ethical challenges extend beyond technical solutions. Informed consent, algorithm transparency, potential biases, unclear accountability, and risks of clinician deskilling have been identified as significant concerns . The complexity of these issues is compounded in child contexts, where consent must be obtained from both parents and children, and where the implications of data collection may not be fully understood by either party.

4.3. Algorithmic Bias and Fairness

Algorithmic bias represents a critical challenge in AI applications for education and psychology. Models trained on homogeneous datasets may produce incorrect or unfair results for underrepresented groups . Fairness-aware machine learning techniques such as adversarial debiasing, reweighting, and active sampling can help ensure subgroups receive equal predictive accuracy, but these techniques are complex and often require specialized expertise to implement effectively.

The fairness challenge is particularly acute in child-centered contexts, where developmental differences, linguistic diversity, and cultural variation may not be adequately represented in training data. Furthermore, the opacity of many high-performing models makes it difficult for teachers, parents, and clinicians to understand how decisions are made, undermining trust and accountability .

4.4. The Need for Human Oversight

While AI systems offer significant potential, they cannot replace human judgment in complex psychological and educational contexts. Experts and stakeholders have emphasized the importance of human-in-the-loop designs that empower teachers and parents . In mental health applications,

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experts favor crisis-only escalation and stronger links to professional resources, while maintaining human oversight for ongoing care .

The role of AI in supporting—rather than replacing—human practitioners is a recurring theme in the literature. AI can augment mental health services by providing scalable, personalized support, but must be integrated into human-led care . Similarly, in educational contexts, AI should support teachers rather than substitute for them, providing actionable insights and reducing administrative burdens while preserving pedagogical autonomy .

5. Implications and Future Directions

The integration of AI into digital tools for child and educational psychology has profound implications for practice, policy, and research.

For practitioners, AI offers tools for more personalized and responsive interventions, but requires new skills for effective implementation. Clinicians and educators must develop AI literacy to evaluate tools critically, interpret AI-generated insights appropriately, and maintain human judgment in decision-making processes. Professional development and training will be essential to prepare practitioners for AI-enhanced practice .

For policymakers, the evidence highlights the need for robust governance frameworks that address safety, privacy, and equity concerns. Current industry practices often lack adequate safeguards, as evidenced by reports that some AI platforms allow systems to engage children in romantic or sensual conversations . Regulatory frameworks must ensure that AI tools for children meet appropriate safety and ethical standards, with mechanisms for ongoing monitoring and accountability.

For researchers, numerous gaps remain to be addressed. Most existing studies rely on self-report data and short-term assessments, limiting insight into the sustained impact of AI on child development and learning . Longitudinal studies are needed to understand how prolonged AI use affects social and emotional development. Additionally, research is needed on the effectiveness of AI interventions across diverse populations, cultural contexts, and developmental stages.

The principles emerging from stakeholder research provide concrete guidance for the design of safe AI tools for youth. At the system and character level, suggested safeguards include movie- or game-style ratings, AI character cards

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disclosing age and likely behaviors, and entry-level AI literacy to help users understand system limits . At the interaction level, stakeholders endorse context-aware monitoring, soft stops rather than abrupt refusals, reflective prompts, and embedding educational dialogue into risky scenarios . At the social level, preferences diverge, with parents favoring broader oversight and experts preferring cautious, crisis-only escalation linked to professional resources .

6. Conclusion

Artificial intelligence is fundamentally transforming digital tools for child and educational psychology, enabling unprecedented levels of personalization, scalability, and responsiveness in educational and mental health interventions. Conversational agents, emotion recognition systems, and adaptive learning platforms offer promising opportunities to address longstanding challenges in meeting children's developmental and psychological needs.

However, the transformative potential of AI must be balanced against significant risks and ethical considerations. Safety concerns, including the potential for emotional dependence, harmful normalization, and inappropriate interactions, require robust safeguards. Privacy and data protection demands careful attention, particularly given the sensitivity of data collected from children. Algorithmic bias threatens to perpetuate or exacerbate educational inequities, while the opacity of many AI systems undermines transparency and accountability.

Realizing the benefits of AI in child and educational psychology requires a human-centered approach that prioritizes children's developmental needs and psychological well-being. Co-design methodologies that actively engage children, parents, and professionals in technology development have demonstrated their value in creating tools that are usable, engaging, and clinically effective. The perspectives of stakeholders—including parents and developmental experts—provide essential guidance for embedding safety into AI companion design.

Ultimately, AI should be viewed as an augmentation of, rather than a replacement for, human expertise in child and educational psychology. The most promising applications integrate AI tools into human-led care, empowering practitioners with actionable insights while maintaining the human connection that remains essential for healthy

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development. As research continues to evolve, longitudinal studies, diverse populations, and rigorous evaluation of long-term impact will be essential for ensuring that AI technologies serve the best interests of children and young people.

References:

- [1] Yuan, R., Wang, K., Wang, Z., & He, W. (2026). Generative artificial intelligence (GenAI) in K-12 schools: A systematic review of teacher motivation and engagement. ScienceDirect.
- [2] (2025). Review of innovative mental health support for children and young people: Generative AI co-design applications and challenges. Springer.
- [3] Laak, K.-J., Abdelghani, R., & Aru, J. (2024). Personalisation is not guaranteed: The challenges of using generative AI for personalised learning. Lecture Notes in Computer Science, 40-49.
- [4] (2025). Navigating anxiety in digital learning: How AI-driven personalization and emotion recognition shape EFL students' engagement. Acta Psychologica, 260, 105466.
- [5] Yu, Y., et al. (2026). Principles of safe AI companions for youth: Parent and expert perspectives. arXiv.
- [6] Zhang, Z. (2025). Computational foundations and educational impacts of AI in child-centered learning. ACM Digital Library.
- [7] (2025). Mitigating student resistance: The role of chatbots in sustainable educational technology integration. Frontiers in Education.
- [8] Adindu, K. N., et al. (2025). Artificial intelligence and digital therapy for adolescent mental health in the UK: Opportunities, barriers, and ethical consideration. SSRN.