

ARTIFICIAL INTELLIGENCE AND EARLY CHILDHOOD DEVELOPMENT: NEW APPROACHES TO COGNITIVE EXPLORATION AND CREATIVE LEARNING

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Abstract

Artificial intelligence (AI) is increasingly becoming part of contemporary educational environments, creating new possibilities for learning, exploration, and creative expression. Although AI research has traditionally focused on older learners, recent studies have begun to examine its potential in early childhood education. This thesis explores how AI can be used as a pedagogical resource to support preschool children's cognitive exploration and creative learning. The study is based on a theoretical analysis of recent research on artificial intelligence in early childhood education, creativity development, teacher mediation, and human-centred AI. The analysis suggests that AI can provide children with new visual, narrative, and problem-based stimuli; however, its educational value depends on how actively children participate in the learning process. The thesis therefore proposes a child-centred approach in which AI-generated content serves as a starting point for questioning, observation, imagination, problem solving, storytelling, and creative production rather than as a substitute for children's own thinking. Particular attention is given to teacher mediation, developmental appropriateness, play-based learning, and ethical considerations. The proposed approach contributes to the emerging discussion on responsible and pedagogically meaningful AI integration in early childhood education.

Keywords: artificial intelligence, early childhood education, preschool children, cognitive exploration, creative learning, creativity, teacher mediation, child-centred learning.

Introduction

Artificial intelligence is rapidly changing the educational landscape. Generative AI systems can produce text, images, stories, questions, and other forms of educational content, creating new opportunities for teachers to design learning experiences. UNESCO's guidance on generative AI emphasizes that such technologies should be implemented through a human-centred and age-appropriate approach, with particular attention to privacy, ethics, and pedagogical design.

Early childhood education requires particular consideration because preschool children learn primarily through play, exploration, communication, observation, and direct interaction with their environment. Therefore, introducing AI into preschool education should not mean increasing children's passive exposure to screens. Instead, AI can be considered a pedagogical resource that stimulates children's curiosity and encourages them to explore ideas.

Recent scholarship demonstrates that this is an emerging research area. A 2025 study by Yang, Li, and Lee proposed the Creative Project Approach, integrating generative AI and robotics into early childhood education through a five-step pedagogical framework involving learning needs, teacher-guided interaction, contextualized AI use, appropriate levels of automation and creativity, and learning-outcome evaluation.

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At the same time, a 2025 critical review of 34 studies on AI in early childhood education found that existing research has largely focused on cognitive and situated perspectives, while broader questions concerning ethics, equity, and the conceptualization of children's relationships with AI require further attention.

These developments indicate that the central question is no longer simply whether AI can be introduced into early childhood education. The more important question is how AI can be integrated without weakening children's independent thinking, creativity, play, communication, and human relationships.

Cognitive Exploration through AI-Supported Learning

Cognitive exploration refers to children's active attempts to understand their environment through observation, questioning, comparison, classification, prediction, experimentation, and problem solving.

AI can contribute to this process by generating stimuli that would otherwise be difficult or time-consuming for a teacher to prepare. For example, an educator can present children with an unusual image and ask them to identify what they observe, explain what might have happened, and propose alternative interpretations.

The important element, however, is not the AI-generated image itself. The educational value emerges from the questions and cognitive activity that follow.

A simple sequence can be formulated as:

AI-generated stimulus → observation → questioning → prediction → discussion → explanation.

For example, children may be shown an imaginary environment containing unfamiliar objects. Instead of explaining the image to them, the teacher can ask:

- What do you see?
- What is unusual?
- Why do you think this happened?
- What could happen next?
- How would you change the situation?

Such questions transform AI-generated content into an opportunity for cognitive exploration.

Recent research on digitally contextualized reading also provides evidence that appropriately designed digital learning experiences can support preschool children's divergent thinking. A quasi-experimental study involving 251 children reported improvements in divergent thinking following digitally contextualized reading activities that incorporated multisensory immersion, emotional engagement, and interactive storytelling.

Although this study does not establish that AI itself caused the observed improvements, it demonstrates the broader pedagogical potential of carefully designed digital learning environments for supporting creative thinking.

AI and Creative Learning

Creativity is an important component of early childhood development. Preschool children express creativity through drawing, storytelling, construction, pretend play, music, movement, and the creation of alternative solutions.

AI can enrich these activities by providing additional stimuli and possibilities.

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For instance, an AI-generated character can become the starting point for a storytelling activity. Children can give the character a name, create its environment, invent a problem, propose solutions, and develop an ending.

The pedagogical sequence may therefore be represented as:

AI stimulus → imagination → transformation → creation → explanation.

The distinction between **AI-generated creativity** and **child creativity** is essential. If an AI system produces a complete drawing or story and the child simply observes it, the activity provides limited evidence of the child's creative development. In contrast, when children transform, reinterpret, extend, or challenge AI-generated material, the technology becomes a stimulus for their own creative thinking.

This position is consistent with recent research proposing AI-supported creative project approaches in early childhood education. Yang, Li, and Lee argue for teacher-guided interaction and an appropriate balance between automation and creativity rather than unrestricted technological automation.

The Teacher as a Pedagogical Mediator

The teacher remains central to AI-supported early childhood learning.

Young children should not be regarded as independent users of AI systems. Instead, the educator should determine:

1. why AI is being used;
2. which content is appropriate;
3. how much technological involvement is necessary;
4. which questions should guide children's thinking;
5. how children will transform the AI-generated material;
6. how learning outcomes will be observed.

Recent research with preschool teachers has similarly identified both pedagogical opportunities and concerns surrounding AI, including creativity, play, professional development, ethics, and data security. Teachers have emphasized that AI-generated images, stories, and prompts may stimulate imagination, while excessive or overly structured AI use could potentially restrict spontaneous play and independent thinking.

Therefore, AI should be integrated into preschool education through a **teacher–child–AI** relationship rather than through direct technology–child interaction alone.

A Child-Centred Framework for AI-Supported Learning

Based on the reviewed literature, a child-centred framework can be proposed:

1. Developmental objective

The teacher identifies the cognitive or creative skill to be developed.

2. AI-supported stimulus

An appropriate image, story, question, scenario, or other AI-generated material is selected.

3. Exploration

Children observe, question, compare, predict, and discuss.

4. Creative transformation

Children modify, extend, reinterpret, or recreate the stimulus.

5. Communication

Children explain their ideas and listen to alternative ideas.

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6. Reflection

Children consider what they discovered and how their ideas changed.

7. Teacher assessment

The educator evaluates children's participation, reasoning, creativity, and communication rather than the technical quality of AI-generated content.

This framework places children's intellectual and creative activity at the centre of the educational process.

Ethical and Developmental Considerations

AI integration in early childhood education also raises important ethical questions.

UNESCO recommends human-centred AI approaches that protect privacy and consider age appropriateness in educational use.

For preschool education, several principles are particularly important:

- children's personal data should be protected;
- AI-generated material should be reviewed by the teacher;
- content should correspond to children's developmental level;
- AI should not replace play and interpersonal communication;
- technological activities should have a clear educational purpose;
- children should remain active participants rather than passive recipients.

A recent review specifically addressing child-centred generative AI integration emphasizes that early childhood is a particularly sensitive developmental period and that AI should support, rather than disrupt, the play-based and relational character of early learning.

Conclusion

Artificial intelligence has the potential to contribute to new forms of cognitive exploration and creative learning in early childhood education. However, this potential depends on pedagogical design rather than technological sophistication alone.

The most meaningful role of AI in preschool education may therefore be understood as that of a **stimulus, creative resource, and pedagogical support tool**. AI can generate unusual situations, visual materials, narratives, and questions that encourage children to observe, wonder, imagine, discuss, and create.

At the same time, children's independent thinking, play, direct experience, and communication with teachers and peers should remain central. The teacher should act as a mediator who determines the purpose, context, level, and boundaries of AI use.

The emerging literature supports the need for child-centred and teacher-mediated approaches, while also demonstrating that this field remains relatively new and requires further empirical research.

Thus, the future of AI in early childhood education should not be defined by the question of how much technology can be introduced into preschool classrooms. A more productive question is how artificial intelligence can be used **to create richer opportunities for children to think, explore, imagine, communicate, and create**.

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