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NDIKIMI I MJETEVE EDUKATIVE TË DREJTUARA NGA INTELIGJENCA ARTIFICIALE TEK ZHVILLIMI KOGNITIV DHE SOCIAL TEK FËMIJËT E MOSHËS 9-14 NË MAQEDONINË E VERIUT

ВЛИЈАНИЕТО НА ЕДУКАТИВНИТЕ АЛАТКИ УПРАВУВАНИ ОД ВЕШТАЧКА ИНТЕЛИГЕНЦИЈА ВРЗ КОГНИТИВНИОТ И СОЦИЈАЛНИОТ РАЗВОЈ КАЈ ДЕЦАТА НА ВОЗРАСТ ОД 9 ДО 14 ГОДИНИ ВО СЕВЕРНА МАКЕДОНИЈА

THE IMPACT OF AI-DRIVEN EDUCATIONAL TOOLS ON COGNITIVE AND SOCIAL DEVELOPMENT IN 9-14 YEAR-OLDS IN NORTH MACEDONIA

Abstract

The rapid integration of artificial intelligence (AI) in education is transforming traditional learning experiences, raising critical questions about cognitive and social development in children and the evolving role of 21st-century families in education. This study explores the impact of AI-driven educational tools on the cognitive and social development of children aged 9-14 in North Macedonia, within the broader context of identity formation and family dynamics.

Through a mixed-methods approach, this research examines how AI-powered platforms-specifically ChatGPT-impact children's problem-solving skills, critical thinking, communication, and collaboration. The study further explores parental and student perceptions of ChatGPT's use in educational settings, as well as the challenges families face in adapting to AI-assisted learning at home and in school. Findings indicate that AI-enhanced learning tools positively impact cognitive development, fostering personalized learning and

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improved engagement. However, concerns emerge regarding social interacttions, dependency on AI for knowledge acquisition, and the shifting role of parental involvement in education. Additionally, disparities in access to AI-driven tools highlight the digital divide, raising ethical considerations about educational equity and identity formation in children from different socioeconomic backgrounds.

This research contributes to the ongoing discussion on the challenges of identity and development in 21st-century families, emphasizing the need for balanced AI integration in education that fosters both technological advancement and human-centric learning experiences. The study provides recommendations for educators, policymakers, and parents on optimizing AI's role in childhood education while preserving traditional learning values and social interactions.

Keywords: *AI in education, cognitive development, social development, family identity, digital learning, 21st-century families, North Macedonia.*

Introduction

The enormous advancement of artificial intelligence in education is seriously challenging the traditional learning experiences hence raising significant questions about identity of the family in 21st century. With the latest technology innovation AI educational tools are being introduced and integrated into every home and classroom with children growing up in an environment where the usage of these AI based educational tools directly influence their cognitive and social development. This evolution presents both opportunities and challenges for families in modern societies.

Certainly, one of the most important challenges of 21-st century families is balancing AI- driven learning with traditional parent-child educational interactions. AI-powered platforms such as ChatGPT, Codementum, DeepSeak and Osmo Learning System personalize education, adapting to individual learning needs, yet they also raise concerns about the diminishing role of parental guidance in early cognitive and social development. How do these tools impact a child's ability to form social connections, develop critical thinking skills, and build a sense of self-reliance? As formal education continues to lose influence**,** AI-based tools are increasingly becoming a natural part of daily life**,** often integrated seamlessly into everyday activities. This growing presence of AI has been accompanied by a rise in cognitive engagement**.** Voice-activated virtual assistants such as Amazon Alexa, Google Assistant, and Apple's Siri now offer a wide range of features - from managing schedules to providing personalized recommendations tailored to users' needs **(**Lee et al., 2023**).** Furthermore, as AI becomes a significant influence on identity

formation, it is crucial to understand how these technologies shape children's perceptions of learning, collaboration, and family engagement in education.

Research suggests that AI-powered educational tools can significantly support memory and attention development in young children by providing personalized and engaging learning experiences. For example, Rose et al. (2021) found that preschoolers who used an AI-based application specifically designed to enhance memory showed notable improvements in both short-term and long-term memory tasks, compared to peers using traditional learning methods. Similarly, Johnson et al. (2020) observed that AI learning platforms capable of adjusting content difficulty in real time help maintain children's attention and engagement, which is essential for continuous cognitive development.

One of the most crucial cognitive abilities formed during early childhood is problem-solving. AI tools - especially educational games - have proven effective in developing this skill by offering adaptive challenges tailored to each child's pace and learning style. For instance, Lee et al. (2022) showed that children using an AI-based game focused on problem-solving demonstrated substantial gains in cognitive flexibility and critical thinking, when compared to a control group using static, non-adaptive games. The customizable nature of AI tools provides a scaffolded learning experience, allowing children to gradually develop more complex problem-solving strategies (Zhu & Ren, 2020). On the other hand, the digital divide In North Macedonia emphasizes the socioeconomic challenges of AI adoption. However, some children benefit from AI-enhanced education others face significant limitations hence deepening educational inequalities and further complicating family identity and development dynamics in the digital age. This research aims to explore how AI-driven educational tools influence the cognitive and social development of children aged 9-14 in North Macedonia, addressing the broader implications for family identity, parenting roles, and educational equity in the digital era. By examining these intersections, this study contributes to the ongoing discourse on how 21st-century families adapt to AI-driven learning and the evolving challenges of childhood development in the modern world.

Problem Statement

The rapid integration of AI-driven educational tools into children's learning environments is reshaping traditional educational experiences. While these tools promise to enhance cognitive development through personalized learning and interactive engagement, their impact on social development and the role of families in early education remains underexplored—especially in the context of developing countries like North Macedonia. There is a growing concern that overreliance on AI technologies may reduce opportunities for interpersonal interaction and shift the educational responsibilities from parents and teachers to machines. Despite these concerns, limited empirical

evidence exists regarding how AI use affects children's problem-solving, logical reasoning, communication, and peer interaction during a crucial stage of development (ages 9-14) This gap calls for focused research to inform educators, policymakers, and families about the benefits and risks of AI in early childhood education.

Research Questions

How does this shift impact family identity and the role of parents in children's education?

Does AI learning complement or replace traditional parent-child educational interactions?

Does early exposure to AI impact a child's independence, creativity, or sense of self-reliance in education?

How do AI-based self-learning methods impact traditional family discussions and peer interactions?

Are children relying more on AI than on family members for knowledge and problem-solving?

How do 21st-century families navigate the challenges of guiding their children in an AI-driven learning environment?

Research Hypothesis

- **H1 (Cognitive Development Hypothesis):**

Children aged 9-14 who use AI-driven educational tools demonstrate significantly greater improvements in cognitive abilities (such as problem-solving and logical reasoning) compared to those who do not use such tools.

- **H2 (Social Development Hypothesis):**

The use of AI-driven educational tools has a mixed impact on social development, with potential enhancements in collaborative learning scenarios but reductions in interpersonal communication in non-guided contexts.

- **H3 (Parental Role Hypothesis):**

The increased use of AI tools in education is associated with a perceived decline in parental involvement, especially in guiding educational activities, compared to traditional learning methods.

Literature Review

Several well-established theories explain children's cognitive development, with one of the most influential being Piaget's theory of cognitive development. According to Piaget (1952), children progress through four stages: sensorimotor, preoperational, concrete operational, and formal operational. During the concrete and formal operational stages, children begin to develop abstract thinking, along with enhanced logical reasoning and problem-solving skills.

At this stage, AI-based educational tools, particularly adaptive learning platforms and problem-solving simulations, can be highly effective in promoting cognitive development. These tools expose children to a wide variety of complex problems, encouraging them to use critical thinking skills and apply their knowledge to new and diverse contexts (Abrar et al., 2025).

Engaging with AI in this way helps cultivate a growth mindset in children - where effort, resilience, and persistence are key drivers of cognitive success (Bayaga, 2024).AI tools impact the development of such cognitive abilities as problem-solving, memory, and decision-making (Ayeniet al., 2024)The concrete operational stage, which spans the ages of 7 to 11 years, is marked by a child's ability to perform logical operations, though their thinking remains tied to concrete, hands-on experiences. The capacity for abstract reasoning and complex problem-solving emerges more fully in the formal operational stage. Applying Piaget's developmental theory to the use of AI educational tools is particularly relevant, as AI can offer interactive and adaptive learning environments tailored to the child's specific stage of cognitive development.

According to Brada and Dahmani (2024), when AI-based tools are designed with Piagetian principles in mind, they can enhance problem-solving abilities in children at the concrete operational stage by exposing them to dynamic and progressively challenging content. These cognitive benefits align with Piaget's assertion that learning tailored to a child's cognitive level leads to improvements in both short-term academic outcomes and long-term cognitive growth.

Lev Vygotsky's socio-cultural theory emphasizes the influence of cultural tools and social interaction on cognitive development. According to Vygotsky (1978), cognitive growth occurs primarily through collaboration and problem-solving within a social context, supported by a process known as scaffolding. This means that children are able to perform better cognitively when guided by more knowledgeable individuals, such as adults or peers. A central concept in his theory is the **Zone of Proximal Development (ZPD)** - the range of tasks a child can complete with assistance, but not yet independently.

Modern research highlights how AI-powered educational tools reflect this scaffolding concept in contemporary learning environments. For instance, AI tutoring systems like Socratic by Google offer real-time guidance and problem-solving assistance, effectively functioning as a virtual extension of the ZPD. As Qawqzeh (2024) points out, such tools align with Vygotsky's

idea of social scaffolding, as they provide adaptive support that helps learners overcome tasks that are slightly beyond their current capabilities. In this sense, AI serves as a facilitative partner, enabling students to gradually build the skills needed to handle more complex learning tasks independently.

Problem-solving is widely recognized as one of the key cognitive skills influenced by artificial intelligence. AI-based tutoring systems are designed to analyze student responses through complex algorithms and provide instant feedback along with suggested steps to approach and solve problems. This process actively promotes the development of logical reasoning and critical thinking skills in learners (Göçmez & Okur, 2023).

In their study published in the Critical Review of Social Sciences Studies (Volume 3, Issue 1, 2025), Ouyang et al. (2023) found that AI systems significantly enhance students' ability to solve complex mathematical problems by offering immediate feedback and adaptive learning pathways. These tools not only verify the accuracy of a learner's response but also assess the reasoning behind it, thereby contributing to improved long-term problem-solving abilities. A recent study by Poquet and De Laat (2021) examined the use of AI in adult learning environments and found that these tools can support memory enhancement and decision-making. However, the cognitive benefits appeared to be less pronounced in adults compared to children. This difference is thought to be linked to variations in cognitive flexibility across developmental stages. Supporting this notion, Novitsky (2024) reported that children aged 6 to 8 outperformed both older children and adults when learning in AI-supported educational settings. These findings suggest that younger learners gain greater cognitive benefits—such as improvements in problem-solving and critical thinking—from AI-based learning environments, likely due to their higher adaptability during early cognitive development. The benefits of AI-based learning appear to be most pronounced during the early stages of cognitive development, particularly in children aged 6 to 8 years. This is likely due to the fact that children at this age are still in the process of developing essential problem-solving and reasoning skills. Their cognitive systems are highly plastic, making them more receptive to new learning experiences, such as those offered by AI tools. During this critical period, when children are refining their logical thinking and systematic reasoning abilities, the interactive and adaptive features of AI technologies are especially well-suited to their developmental needs. AI tools provide real-time feedback and personalized problem-solving challenges, which can effectively stimulate cognitive growth in a manner that aligns with the child's developmental stage.

The growing presence of artificial intelligence (AI) in society is transforming various aspects of life, including early childhood development. While AI holds great promise for enhancing children's well-being and adderssing global challenges, it also raises important concerns related to security, safety, and equity. Its increasing influence signals a significant shift in the way we

support and educate young children. As a transformative force in early learning, AI must be considered a critical factor when discussing childhood development. Since interactions with AI occur during sensitive and formative developmental stages, they may leave lasting effects that warrant deeper exploration. To ensure appropriate responses from technology developers, policymakers, and caregivers, a better understanding of AI's impact is urgently needed. Yet, this leads us to a fundamental question: how much do we truly know about these effects?

While artificial intelligence (AI) offers promising opportunities for early childhood development, it also presents critical challenges. Concerns include data privacy, as AI systems often collect sensitive information about children, and inequitable access, which may widen the education gap for underserved communities (UNICEF, 2024). Overreliance on AI could reduce vital human interactions, affecting children's social, emotional, and cognitive growth (HealthyChildren.org, 2023; Time, 2022). AI tools cannot fully replace the depth of human connection essential for developing empathy and critical thinking (Xu, 2024). Ethical issues, including consent and responsible use, also arise. To ensure AI benefits young learners, it is essential to address these risks by prioritizing privacy, equity, human interaction, and ethical standards, offering valuable directions for further research (Family, 2024; Zero to Three, 2024).

Artificial intelligence has the potential to support children's learning and development, especially when designed with developmental needs in mind (Xu, 2024). However, AI literacy is essential - educators and parents must understand how to guide children in using AI tools effectively. While AI can personalize learning and boost engagement, challenges remain around ethical use, privacy, overreliance, and the impact on social interaction (UNICEF, 2024; Psychology Today, 2025). Responsible integration and adult supervision are key to ensuring AI enhances rather than hinders children's development (The Guardian, 2025).

The integration of AI-driven educational tools is reshaping traditional learning dynamics, influencing family roles, children's development, and social interactions. AI tools are shifting some educational responsibilities from parents and teachers to technology, which may alter family identity by redefining parental involvement in education (Harvard Graduate School of Education, 2024). While AI can personalize learning, it may also reduce direct parent-child engagement. Maintaining a balanced approach, where AI complements but does not replace parental roles, is crucial (Famly, 2024).

Cognitive and social development are key components of identity formation. AI tools influence how children think, interact, and engage with knowledge, shaping their self-identity as learners. Although AI can enhance cognitive skills through tailored learning experiences, excessive use may negatively affect adolescents' social adaptability and reduce family support (SpringerLink, 2024; HealthyChildren.org, 2023). Early exposure to AI can

impact a child's independence, creativity, and sense of self-reliance in education. If not monitored, children may become passive consumers of information, risking delays in the development of critical thinking and problem-solving skills (Psychology Today, 2025; Xu, 2024). AI tools may either reduce or enhance social interactions among children. Collaborative platforms can encourage teamwork and communication, but overuse of self-learning tools may reduce peer interactions and limit the development of social skills (SpringerLink, 2024). AI-based self-learning also impacts traditional family discussions. Children relying heavily on AI may engage less with parents and siblings, altering the dynamic of learning within the home (UNICEF, 2024). Encouraging conversations about AI-based learning outcomes within the family can help maintain relational ties and promote meaningful dialogue (Zero to Three, 2024). There is growing concern that children may turn to AI more than to parents or teachers for problem-solving and learning support (Harvard Graduate School of Education, 2024). While AI delivers quick answers, it lacks the emotional understanding and contextual depth that human guidance provides. Encouraging children to verify AI-given information through family or teacher discussions preserves the role of interpersonal relationships in the learning journey (The Guardian, 2025; Business Insider, 2025). Parents face increasing challenges with managing screen time, ensuring privacy, and addressing ethical dilemmas around AI use in education. Setting appropriate boundaries, staying informed about digital risks, and fostering open communication are crucial strategies (HealthyChildren.org, 2023; Business Insider, 2025). Families in the 21st century must adapt by developing digital literacy, maintaining involvement in their children's learning, and collaborating with educators to ensure responsible AI integration (UNICEF, 2024). In conclusion, while AI-driven educational tools offer substantial benefits, their effectiveness depends on thoughtful engagement by families and educators. Balancing AI with traditional human interaction, promoting critical thinking, and maintaining open channels of communication can mitigate potential drawbacks and foster holistic child development (Harvard Graduate School of Education, 2024; Time, 2022).

Methodology

This study follows an empirical research design to evaluate the impact of artificial intelligence (specifically ChatGPT) on students aged 9–14. Data were collected through a comparative experimental method involving two groups of students, as well as structured surveys completed by parents and external students. This allowed for a comprehensive assessment of both academic performance and emotional experience related to the use of AI tools in education.

Study Objective

The aim of this study is to analyze the influence of artificial intelligence, particularly ChatGPT, on students' efficiency, accuracy and emotional experience during the learning process. Additionally, the study considers parental and student perceptions regarding the use of AI tools in education.

Methodological Design

The study is divided into two parts:

I. Experimental comparative study with 50 students:

- 25 students – control group: not allowed to use ChatGPT during problem-solving.
- 25 students – experimental group: allowed to use ChatGPT as a support tool during problem-solving.

II. Survey data collected from 100 parents and 110 students who were not part of the experimental group.

I - Experimental comparative study

Experimental Procedure (Comparative Study)

The purpose of this experimental part was to practically test the impact of ChatGPT on students' ability to solve academic tasks and answering first hypothesis :

- Hypothesis 1a: Students using ChatGPT will complete tasks faster than those who do not.
- Hypothesis 1b: Students using ChatGPT will feel less stressed.
- Hypothesis 1c: Students using ChatGPT will solve problems more accurately.

Students (50) of age 9-14 years old were divided into two groups:

- Group A (without ChatGPT): Students completed the tasks using only their own knowledge.
- Group B (with ChatGPT): Students were allowed to use ChatGPT as a support tool (not as a direct answer provider). Each student was given three tasks (Science, Math, and Science+Math), all of equal difficulty and format.

Procedure:

1. Explanation of the purpose and rules of the experiment.
2. Students completed the tasks individually, without help from teachers.
3. Group B was allowed to consult ChatGPT while solving.
4. Time taken to complete tasks was recorded (students had up to 45 minutes).
5. Number of tasks successfully completed was evaluated.
6. Students completed a post-task emotional survey to assess their experience.

Tools and Materials

- ChatGPT (support tool for Group B)
- Traditional textbooks and worksheets
- Identical assignments for both groups
- Identical emotional questionnaire for both groups after completing the tasks

Variables that were tested

- Independent variable: Use or non-use of ChatGPT
- Dependent variables:
- Time to complete tasks
- Number of correctly solved tasks
- Emotional responses (stress, confusion, ease, satisfaction)

Collected Data

- Quantitative data:
- Time (in minutes) to complete the tasks
- Accuracy score (from 0 to 3)
- Qualitative data:
- Emotional experiences (stress, confusion, ease, satisfaction)

Results of the Comparative Experiment

Measured Variable	Without ChatGPT	With ChatGPT	p-value	Interpretation
Task completion time (min)	25.3	21.5	0.031	*Statistically significant: faster with ChatGPT*
Answer accuracy (0–3)	1.8	2.6	0.014	*Statistically significant: more accurate*
Stress/perception survey	/	/	1.000	*No significant emotional difference*

- **Hypothesis 1a – The use of ChatGPT will help students complete tasks faster than those who do not use ChatGPT.**

To test this hypothesis, the time (in minutes) required by each student to complete the test was measured. The group without ChatGPT had an average completion time of 25.3 minutes, while the group with ChatGPT completed it in an average of 21.5 minutes.Statistical analysis was conducted using an independent samples t-test, which resulted in a p-value of 0.031. Since this p-value is less than the standard significance level ($\alpha = 0.05$), the result is considered statistically significant.

Therefore, ***Hypothesis 1a is accepted:*** ChatGPT helps students complete tasks more quickly.

- **Hypothesis 1b – Students who use ChatGPT will feel less stressed during the problem-solving process.**

To evaluate this hypothesis, a post-test questionnaire was used to assess students' emotional perceptions, including stress and perceived difficulty during the task.

After conducting a t-test analysis, the p-values for all questions were 1.00, indicating no statistically significant differences between the two groups.

Since the p-value is much higher than 0.05, there is no statistically valid evidence to support this hypothesis. Therefore, ***Hypothesis 1b is rejected.***

- **Hypothesis 1c – Students who use ChatGPT will respond more accurately than those who do not.**

Student accuracy was measured based on the number of points they scored on the test, with a maximum score of 3. The group without ChatGPT had an average score of 1.8, while the group with ChatGPT had an average of 2.6. Statistical analysis was again performed using an independent samples t-test, and the resulting p-value was 0.014.

Since this p-value is less than 0.05, the result is considered statistically significant.

This indicates that the use of ChatGPT significantly improves answer accuracy. Therefore, ***Hypothesis 1c is accepted.***

The data show that ChatGPT has a positive practical impact on students: reducing time needed and increasing accuracy. However, it does not significantly affect students' emotional perception of the task. For future studies, a larger sample and a wider variety of task types are recommended.

II. Survey data collected

Survey data collected from 100 parents and 110 students who were not part of the experimental group.aimed to understand their knowledge, attitudes, and observations regarding their children's use of AI in learning. The key results are:

Demographics

- **Age:** Majority of parents fall within the 25–45 age range.
- **Gender:** Most respondents were female**.**
- **Education Level:** A large proportion had completed secondary or higher education**.**

AI Awareness and Understanding

- Most parents had heard of AI**, but** only some could explain it clearly**.**
- When asked whether they could describe AI in their own words, many expressed limited confidence**,** though some said they would recommend it to others**.**

Use of AI Tools at Home

- Frequently mentioned tools included ChatGPT, YouTube, Google, Alexa, and Siri**.**
- Most parents reported that their children use AI tools regularly at home for learning.

Children's Engagement and Learning

- Many parents noted that their children enjoy learning with AI tools**.**
- A high percentage confirmed that AI tools helped their children complete homework or solve problems more easily.
- Most parents believed that AI tools assist children in understanding difficult school subjects**.**

Parental Role and Child Independence

- When asked about their child's independence in using AI tools, over 50% of parents stated that their children work independently, with minimal support.
- This suggests a reduction in parental involvement during learning sessions where AI is used.

Effectiveness of AI

- The majority of parents observed noticeable improvements in their children's comprehension and problem-solving skills since using AI tools.

The student questionnaire collected responses from 110 children aged **9–14**, focusing on their use, understanding, and perceptions of AI in education.

Technology Use in Learning

- A significant number of students reported using devices (phones, tablets, computers) to learn.

- Many also use educational apps or games that help them understand academic content.

Awareness and Understanding of AI

- Most students were familiar with the concept of AI**,** and over 60% gave accurate explanations**.**
- The majority could correctly identify ChatGPT, Alexa, Siri as AI-based platforms.

AI in Practice

- ChatGPT was the most frequently used AI platform for learning.
- 86.4% of students believed that AI helped them during learning.
- Many reported feeling relieved when AI gave them correct answers to questions they couldn't solve on their own.

Learning Preferences

- Over 56% preferred to learn with a teacher but also use AI occasionally, while only 9.2% said they would rather learn exclusively with AI.
- **89%** of students believed **teachers are essential,** and that AI tools should only serve as support.

Cognitive and Emotional Impact

- Students reported that AI helps them better understand lessons**,** organize their time, and think differently**.**
- Despite positive responses, some students expressed concerns about answer quality, complexity, and misunderstandings when using AI tools.

Trust and Social Dynamics

- When facing difficulties, students mostly turn to their **teacher first**, then **ChatGPT,** followed by **parents or peers.**
- Most said they would **recommend AI tools to their friends.**

Evaluation of Hypotheses Based on Experimental comparative study and the Survey

- **H1 – Cognitive Development Hypothesis**

"Children aged 9–14 who use AI-driven educational tools demonstrate significantly greater improvements in cognitive abilities (such as problem-solving and logical reasoning) compared to those who do not use such tools."

The experimental design compared two groups of students (with and without ChatGPT) on task completion time and accuracy—both valid indicators of cognitive ability. Independent samples t-tests were applied to evaluate performance differences. Students using ChatGPT performed tasks faster (21.5 vs. 25.3 minutes, $p = 0.031$) and scored higher on accuracy (2.6 vs. 1.8 points, $p = 0.014$). Survey feedback also supported enhanced problem-solving and comprehension.

- **H2 – Social Development Hypothesis**

"The use of AI-driven educational tools has a mixed impact on social development, with potential enhancements in collaborative learning scenarios but reductions in interpersonal communication in non-guided contexts."

While the experimental design focused on individual performance, social dimensions were explored through student surveys, including whom students seek help from, learning preferences, and attitudes toward AI.

Most students still preferred teachers over AI for help. Only 9.2% favored learning solely with AI, and 89% believed that AI should support—not replace—teachers. However, some students reported reduced interaction with peers or parents.

- **H3 – Parental Role Hypothesis**

"The increased use of AI tools in education is associated with a perceived decline in parental involvement, especially in guiding educational activities, compared to traditional learning methods."

This hypothesis was addressed via a structured survey of 100 parents, focusing on AI usage at home and parental involvement in children's learning. Over 50% of parents reported that their children used AI tools independently. Many indicated a decrease in their own involvement during AI-assisted learning sessions.

Conclusion

This study examined the impact of AI-driven educational tools - particularly ChatGPT - on the cognitive and social development of children aged 9–14 in North Macedonia. Through a mixed-methods approach combining experimental research and survey data from students and parents, the findings reveal that AI tools, when thoughtfully integrated into education, can enhance cognitive development by improving task efficiency and accuracy. ChatGPT, as a support tool, was found to significantly aid students in completing tasks more quickly and with greater precision.

However, the results also highlight nuanced effects on social development. While AI tools can promote independent learning, they may also contribute to reduced peer and parent-child interaction, especially in unguided contexts. Survey responses indicated a shift in children's reliance toward AI tools over interpersonal engagement, particularly for problem-solving. Most students and parents valued the use of AI but emphasized that human educators remain central to the learning process.

Moreover, findings supported the hypothesis that increased AI use correlates with decreased parental involvement in daily educational tasks. Over half of the surveyed parents reported that their children used AI tools independently, suggesting a potential redefinition of the parental role in education.

While cognitive development benefits are evident, this study calls for cautious implementation of AI tools in education. It is essential to maintain a balanced approach where AI complements rather than replaces human interaction. Encouraging collaborative learning, teacher guidance, and parental engagement remains crucial to holistic child development.

The research questions posed at the beginning of this study were largely addressed:

- AI use was shown to enhance cognitive function, supporting H1.
- Social interaction showed mixed results, confirming H2 in part.
- Parental involvement was shown to decline, confirming H3.

Future research should explore the long-term effects of AI use on creativity, emotional development, and peer collaboration. Policymakers and educators must develop frameworks that ensure AI is used ethically, equitably, and in developmentally appropriate ways.

In conclusion, AI - especially tools like ChatGPT - holds transformative potential in education. Yet its success depends not only on the technology itself but on how thoughtfully it is embedded into learning environments. A human-centered approach, combined with digital innovation, will be key to shaping the future of education and the next generation of learners.

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