IMPACT OF ARTIFICIAL INTELLIGENCE TOOL USAGE ON STUDENT COGNITION ACROSS ACADEMIC FIELDS

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Abstract: *The rapid expansion of Artificial Intelligence (AI) in education raises critical questions about its cognitive impact on students. This study examines the effects of AI tools on general cognitive performance and reflective problem-solving abilities among students from Medicine, Economics, and Information Technology. A total of 150 students (mean age: 18.33±1.13 years) participated, divided into AI users and non-users. Cognitive performance was assessed using the Montreal Cognitive Assessment (MoCA) and the Frederick test. Results indicate that AI usage improves cognitive outcomes across fields, with the strongest impact in IT, followed by Economics and Medicine. These findings highlight the importance of discipline-specific AI integration strategies to optimize student learning and cognitive development.*

Keywords: *Artificial Intelligence, Student Cognition, Academic Fields, Problem-Solving, Cognitive Abilities*

ВЛИЯНИЕ ИСПОЛЬЗОВАНИЯ ИНСТРУМЕНТОВ ИСКУССТВЕННОГО ИНТЕЛЛЕКТА НА КОГНИТИВНЫЕ СПОСОБНОСТИ СТУДЕНТОВ В РАЗЛИЧНЫХ АКАДЕМИЧЕСКИХ ОБЛАСТЯХ

Аннотация*: Расширение использования искусственного интеллекта (ИИ) в образовании вызывает важные вопросы о его влиянии на когнитивное развитие студентов. В данном исследовании анализируется воздействие ИИ-инструментов на общие когнитивные способности и навыки рефлексивного решения задач у студентов медицинского, экономического и информационно-технологического направлений. В исследовании приняли участие 150 студентов (средний возраст: 18,33±1,13 года). Когнитивные способности оценивались с помощью теста MoCA и теста Фредерика. Результаты показали, что использование ИИ положительно влияет на когнитивные показатели, наибольший эффект наблюдается у студентов ИТ, затем у студентов экономического и медицинского направлений. Полученные данные*

подтверждают необходимость разработки специализированных стратегий интеграции ИИ в различных дисциплинах.

Ключевые слова: *Искусственный интеллект, когнитивные способности, студенты, решение задач, образование*

SUN'IY INTELLEKT VOSITALARIDAN FOYDALANISHNING TURLI TA'LIM SOHALARIDA TALABALARNING KOGNITIV QOBILIYATLARIGA TA'SIRI

Annotatsiya: *Ta'lim jarayonida sun'iy intellekt (SI)dan foydalanish tobora kengayib, uning talabalarning kognitiv rivojlanishi va aqliy qobiliyatlariga ta'siri muhim masalaga aylanmoqda. Ushbu tadqiqot tibbiyot, iqtisodiyot va axborot texnologiyalari yo'nalishidagi talabalarda SI vositalarining umumiy kognitiv faoliyat va reflektiv muammolarni hal qilish ko'nikmalariga ta'sirini o'rganadi. Tadqiqotda 150 nafar talaba (o'rtacha yosh: 18,33±1,13) ishtirok etdi. Kognitiv qobiliyatlar MoCA testi va Frederik testi orqali baholandi. Natijalar shuni ko'rsatdiki, SI dan foydalanish kognitiv ko'rsatkichlarni yaxshilaydi, eng katta ta'sir axborot texnologiyalari sohasida, undan keyin iqtisodiyot va tibbiyotda kuzatildi. Tadqiqot natijalari sohalarga xos SI integratsiya strategiyalarini ishlab chiqish zarurligini ta'kidlaydi.*

Kalit so'zlar: *Sun'iy intellekt, kognitiv rivojlanish, talaba, muammolarni hal qilish, ta'lim*

Introduction

The integration of Artificial Intelligence (AI) into education has transformed traditional learning and teaching methods. AI-based tools assist students in solving complex problems, managing information, and improving critical thinking. However, debates persist regarding the extent to which AI contributes to cognitive development versus encouraging dependency. To address this, our research investigates AI's role in enhancing students' cognitive abilities across three academic fields—Medicine, Economics, and Information Technology.

Literature Review

The rapid integration of Artificial Intelligence (AI) into higher education has prompted researchers to explore its impact on teaching, learning, and cognition. A growing body of evidence suggests that AI tools not only support academic tasks but also influence how students think, solve problems, and engage with knowledge.

Castillo-Martínez et al. (2024) conducted a systematic review of AI in higher education and emphasized its role in enhancing personalized learning and student engagement. Their findings indicate that AI-powered platforms can scaffold cognitive

processes by offering adaptive feedback and tailored learning pathways. This supports the argument that AI contributes to the development of general cognitive skills when used meaningfully.

Similarly, Liang et al. (2025) highlighted in their systematic review that AI has begun reshaping curriculum, instruction, and assessment in higher education. They reported that students exposed to AI-assisted learning environments often display improved problem-solving and analytical abilities. However, they also cautioned that differences exist across disciplines, with technical fields such as IT showing faster integration than fields requiring human-centered reasoning, such as medicine.

A study on faculty perspectives further underscores these trends. According to *Frontiers in Education* (2025), academic staff perceive AI as a transformative force that can augment critical thinking and reflective abilities. However, they also raise concerns about over-dependence on automated tools, which could limit students' capacity for independent reasoning if not carefully managed.

Trujillo, Pozo, and Suntaxi (2025) examined AI-driven machine learning approaches in education, particularly in predicting student career pathways. Their systematic review showed that AI tools significantly enhance data-driven decision-making and problem-solving skills among students. This suggests that exposure to AI systems strengthens reflective thinking by encouraging students to weigh multiple scenarios before making judgments.

In addition, Ogunleye et al. (2024) synthesized findings from generative AI applications in teaching and learning. They found that tools such as ChatGPT foster higher-order cognitive engagement when used interactively, especially in fields requiring creative and analytical reasoning. Their review, however, also highlighted the importance of integrating AI responsibly to prevent cognitive shortcuts and superficial learning.

Taken together, these studies indicate that AI use is broadly associated with improvements in cognitive abilities, including general reasoning and reflective problem-solving. At the same time, the benefits appear to vary depending on the academic field, the type of AI tools employed, and the way they are integrated into educational practice. This supports the need for field-specific investigations—such as the present study—into how AI usage affects student cognition in medicine, economics, and information technology.

Research Methodology

This study employed a comparative cross-sectional design to examine the influence of Artificial Intelligence (AI) tool usage on student cognition across three academic fields: Medicine, Economics, and Information Technology (IT).

Participants. A total of 150 undergraduate students participated, with equal representation from each field (n = 50 per group). The mean age was 18.33 ± 1.13

years. Participants were stratified into two subgroups based on self-reported AI usage in academic tasks: **AI users** (students who regularly employed AI-powered tools such as ChatGPT, Grammarly, or AI-based learning platforms for studying, problem-solving, or coursework) and **non-users** (students who did not use AI tools in their academic routine).

Instruments. Two validated instruments were used:

1. **Montreal Cognitive Assessment (MoCA)** – a widely recognized screening tool for general cognitive ability. Scores were categorized into *normal cognitive function* and *low cognitive function* according to established cut-offs.
2. **Frederick's Cognitive Reflection Test (CRT)** – a measure of reflective problem-solving and the ability to override intuitive but incorrect responses. Scores of 2–3 were classified as *good reflective problem-solving*, while scores of 0–1 were classified as *low*.

Procedures. Data collection took place in a classroom setting. Participants completed both assessments under supervision. Demographic information (age, gender, field of study, and AI use status) was collected.

Statistical Analysis. Descriptive statistics (mean, standard deviation, and percentages) were used to summarize demographic and performance data. Group comparisons were conducted within each field to identify differences between AI users and non-users. Results were presented field by field to capture domain-specific variations in AI's impact on cognitive abilities.

Analysis and results

Across all fields, AI users demonstrated higher cognitive performance on both the MoCA and CRT compared to non-users. This suggests that engagement with AI tools may be positively associated with general and reflective cognitive abilities.

Medicine.

- MoCA: AI users scored **28.12 ± 1.47**, compared to **27.40 ± 1.72** for non-users.
- Cognitive categories: 44% of AI users vs. 32% of non-users achieved *normal cognitive performance*.
- CRT: AI users outperformed non-users, with a higher proportion achieving good reflective problem-solving scores.
- Interpretation: While improvements were observed, the magnitude of difference was smaller than in other fields, reflecting the complex, human-centered reasoning required in medicine.

Economics.

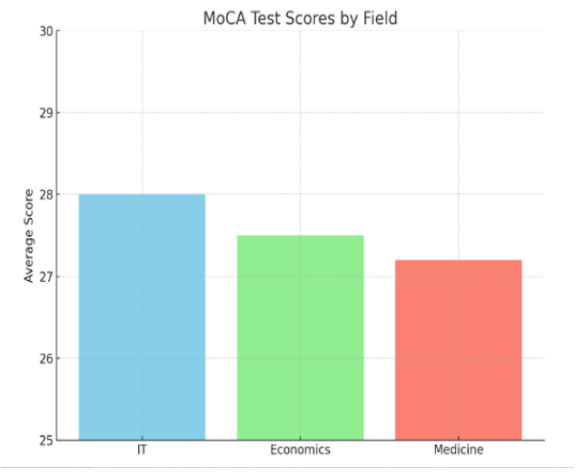
- MoCA: AI users averaged **27.94 ± 1.55**, while non-users averaged **26.90 ± 1.88**.
- Cognitive categories: 68% of AI users vs. 56% of non-users scored within the *normal range*.

- CRT: A clear advantage for AI users, indicating enhanced reflective decision-making and analytical skills.
- Interpretation: Economics students appeared to benefit from AI's capacity to support data analysis and structured reasoning.

Information Technology (IT).

- MoCA: AI users scored **28.02 ± 1.68**, while non-users scored **27.34 ± 1.84**.
- Cognitive categories: 78% of AI users vs. 54% of non-users demonstrated *normal cognitive performance*.
- CRT: AI users showed the strongest performance across all groups, with a majority achieving good reflective problem-solving.
- Interpretation: IT students experienced the most pronounced cognitive benefits, likely due to their familiarity with digital technologies and natural integration of AI into learning processes.

Comparative Summary. Results indicate a field-specific gradient of AI impact: strongest in IT, moderate in Economics, and more modest in Medicine. Nonetheless, the consistent trend across fields suggests a general positive influence of AI usage on both general cognitive function and reflective problem-solving.





Conclusion. The findings of this study demonstrate that AI usage is associated with enhanced cognitive abilities among university students, both in general cognition and reflective problem-solving. However, the degree of improvement varies across academic fields, with IT students showing the greatest gains, followed by Economics, and then Medicine. These differences may be attributed to variations in the relevance of AI tools to each discipline, students' digital literacy, and the types of cognitive challenges inherent in each field.

The results align with recent research indicating that AI tools can promote cognitive engagement and higher-order thinking when used constructively (Essel et al., 2024; Promma et al., 2025). At the same time, the study reinforces the need to prevent over-reliance, which may compromise independent reasoning (Zhai et al., 2024).

Recommendations.

1. **Discipline-specific AI integration.** Educational programs should design AI-supported learning strategies tailored to the needs of each field. For example, IT curricula may emphasize collaborative AI problem-solving, while Medicine may focus on AI as a supportive diagnostic aid rather than a replacement for clinical judgment.
2. **AI literacy training.** Institutions should offer structured training in AI literacy to help students critically evaluate AI outputs and avoid uncritical acceptance of generated responses.
3. **Balanced use.** AI tools should complement—not replace—human reasoning. Faculty should encourage hybrid approaches where students actively combine their own problem-solving skills with AI support.
4. **Assessment design.** Universities should consider incorporating AI-aware assessments that measure both independent and AI-assisted problem-solving to reflect real-world applications.
5. **Further research.** Longitudinal studies are needed to explore how sustained AI usage affects cognition over time and whether the benefits observed persist beyond immediate problem-solving tasks.

By implementing these strategies, higher education institutions can leverage AI to strengthen cognitive development while safeguarding the critical and reflective thinking skills essential for academic and professional success.

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