

How does AI affect Cognitive Learning Functions?

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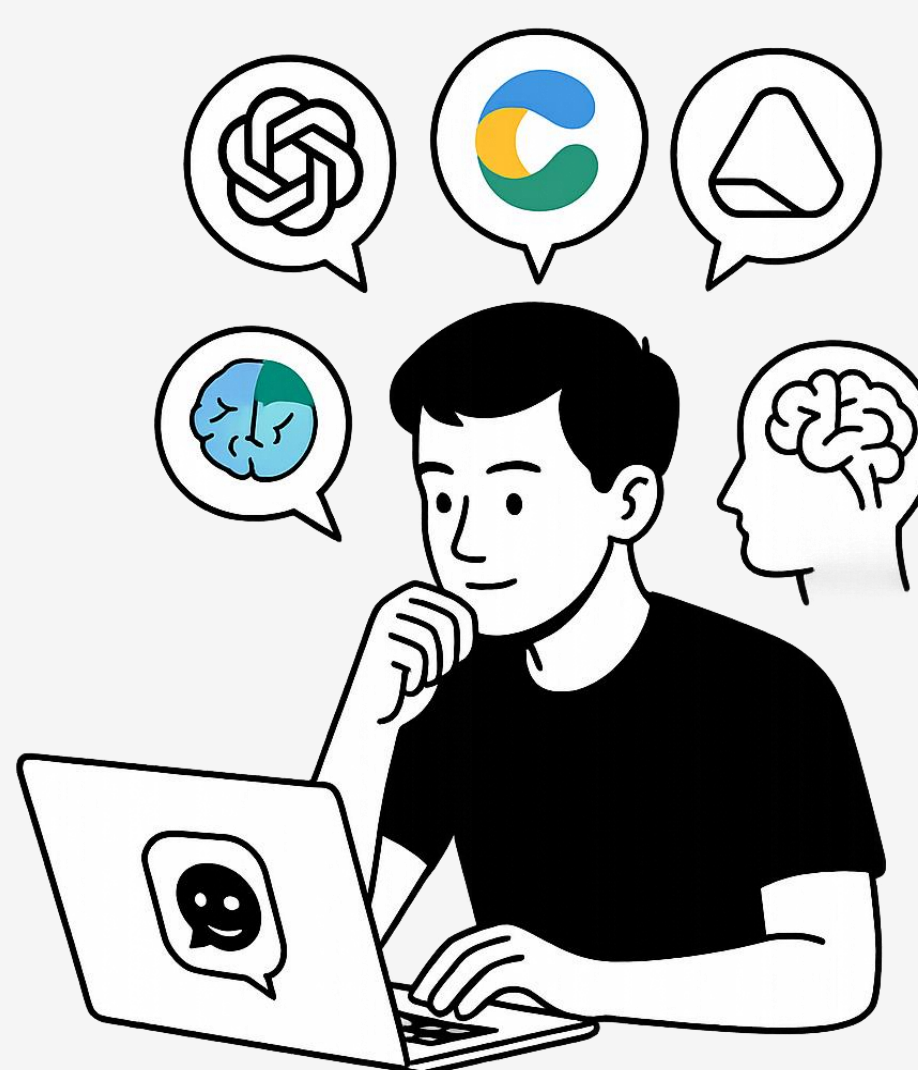
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Background

The widespread adoption of Generative Artificial Intelligence (GenAI) in educational settings has transformed how students approach learning. While these technologies “promise to revolutionize research and education by streamlining repetitive tasks, aiding in data interpretation, and pioneering new learning and assessment methods”, little is known about their cognitive impacts on learning (Zhai et al. 2024, 2).

This study seeks to explore whether GenAI chatbots such as ChatGPT, Gemini, and MS Copilot enhance LSE students' learning experiences or detract from their courses' intended learning outcomes. This study employs a mixed-methods approach, integrating survey data with semi-structured focus groups, to examine patterns of AI usage and its effects on cognitive learning processes.



Literature review

Since its introduction into the educational landscape, GenAI has attracted considerable scholarly interest as an emerging pedagogical tool. Existing research has largely concentrated on usage patterns, trends, and the various purposes for which students employ AI technologies (Freeman 2024; Johnston et al. 2024; Moran and Ackerman 2024). A significant portion of the literature has also examined the ethical implications of GenAI, particularly in relation to academic integrity (Litvinaite 2023; Luo 2024).

However, relatively few studies have explored the cognitive effects of GenAI on learning processes and outcomes. This study seeks to address this gap by investigating how GenAI impacts students' cognitive skills and performance.

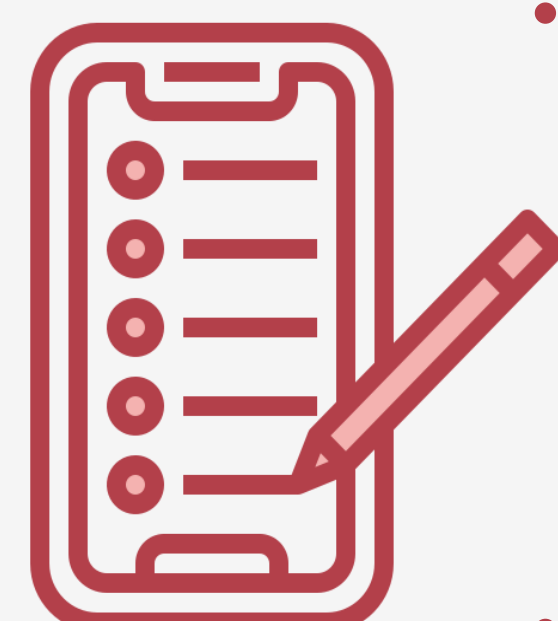


Methodology

This study utilized a **mixed-methods** approach to combine quantitative and qualitative insights on the cognitive impacts of AI on learning.

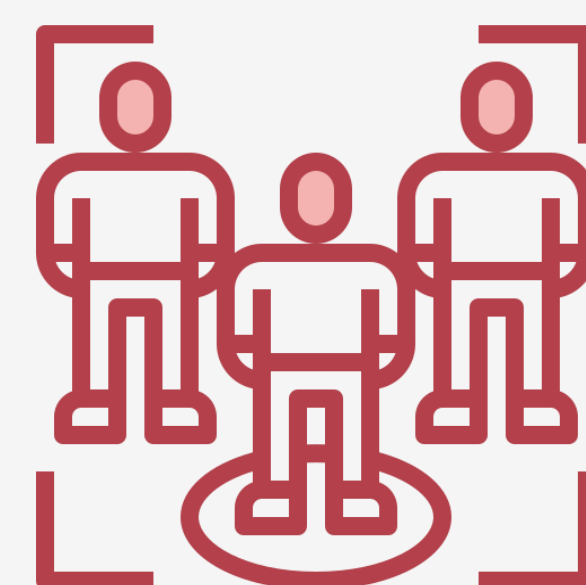
1. Survey

- **RQ: How do students use AI for learning?**
- **Purpose:**
 - When, for what tasks, and with what keywords students use AI.
 - A self-assessment of AI's impact on **memory, comprehension, critical thinking, group work, creativity.**
- **Target:** all LSE students
- **Responses:** 164 in total, 104 valid
- **Recruitment strategies:** posters, Dept newsletters, QR codes in classrooms.



2. Focus Groups

- **RQ:** How does AI affect cognitive learning functions?
- **Purpose:** the impact of AI on the cognitive learning functions.
- **Structure:** 2 experiment-style groups, 8 students each
- **Recruitment strategies:** random sampling, non-random signups.

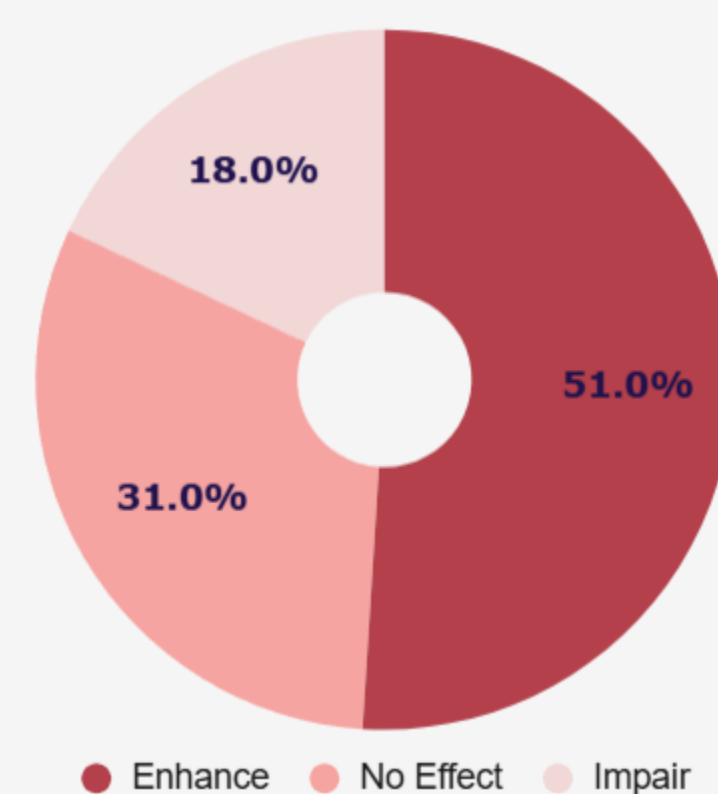


This study was approved by the Research Ethics Committee of the LSE and complies with the UK Data Protection Act 2018.

Findings

Deep Comprehension (DC)

Survey Self-assessment



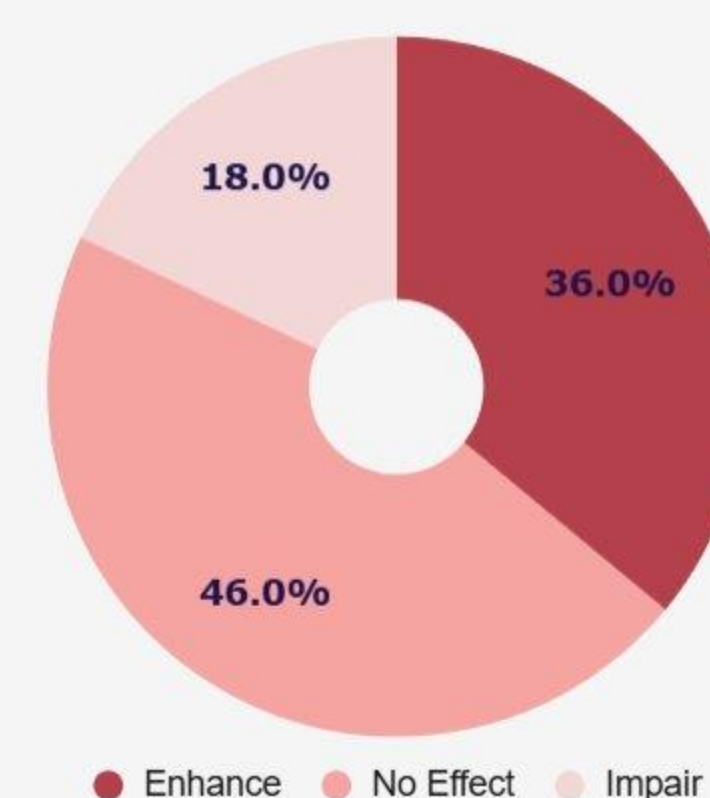
Focus Groups Assessment

- Alignment with survey results
- AI seems to enhance DC
- AI is most useful for examples and to ask follow up questions
- Time constraints positively predicted AI usage
- Impact depends on using AI as a supplementary tool or as a replacement for reflection

Findings (continued)

Critical Thinking (CT)

Survey Self-assessment

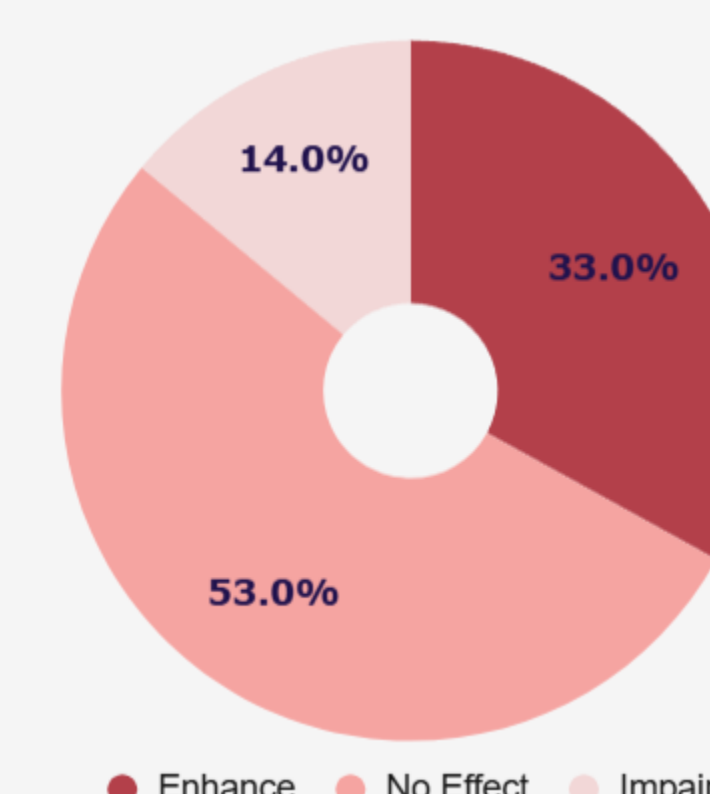


Focus Groups Assessment

- AI seems to enhance CT
- AI strengthens reasoning and ability to construct arguments and counterarguments:
 - Identifies inconsistencies
 - Presents diverse perspectives
 - Provides supporting examples
- Most useful under time constraints

Group Work & Creativity

Survey Self-assessment

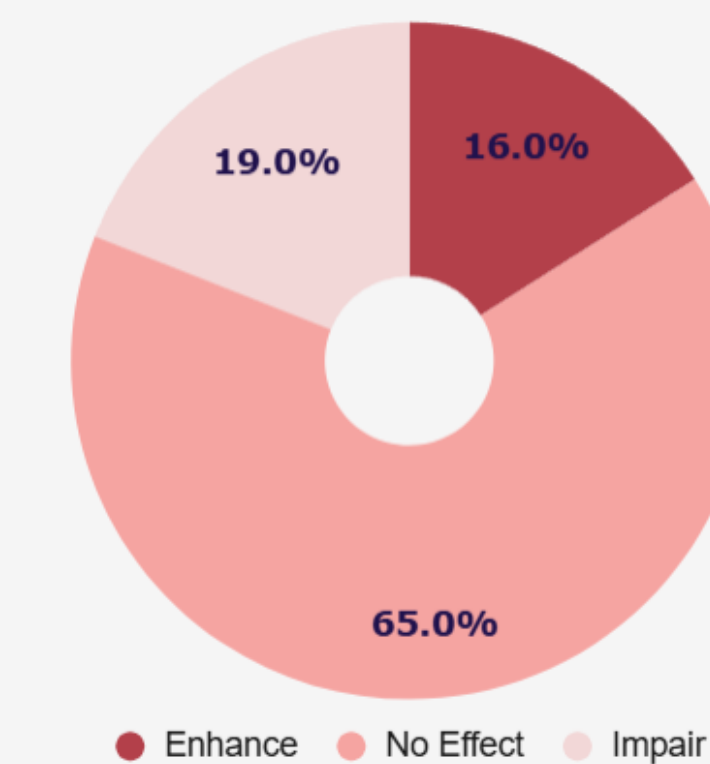


Focus Groups Assessment

- AI seems to inhibit collaborative learning and creativity
- AI-groups showed less communication, less engagement with creative thinking, and reliance on AI ideas
- Non-AI-groups showed more communication and more innovative, experience-tailored, implementable ideas

Memory

Survey Self-assessment



Focus Groups Assessment

- Memory analysis proved difficult in focus groups
- AI's impact on memory remains unclear and merits further research.

AI Concerns Students opposing AI use cited concerns about work theft, plagiarism, accuracy issues, misinformation, and environmental impact.

Key conclusions

- 1 Collaborative learning suffers when AI replaces human interaction:** Groups using AI showed reduced creativity, less communication, and more passive engagement
- 2 Time pressure and prior knowledge determine AI's use:** Students are more likely to use AI under time constraints and are less likely to use these tools when they are already familiar with a topic/concept
- 3 AI enhances argumentative reasoning:** Students find AI particularly helpful for finding counterarguments and identifying inconsistencies in their reasoning, especially when dealing with controversial topics where online sources often reflect their existing viewpoints
- 4 AI's impact on learning varies significantly by cognitive function:** While these tools seem to enhance deep comprehension and critical thinking, they show minimal effect on memory and may hinder group work and creativity
- 5 Context and usage approach determine the impact of AI on cognitive learning function:** AI is most beneficial for learning when it is used as a *supplementary verification tool* rather than a replacement for critical thinking. Students show resourcefulness by checking AI responses through independent research

References

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