



RESEARCH COMMUNICATION Artificial Intelligence / Higher Education / Cognitive offloading

Cognitive Offloading in the Age of AI: A Technical Analysis of Skill Degradation in Novice Programmers

An extensive overview of how Artificial intelligence is changing life and mindset of students passively and slowly

By **Muhammad Tafseer** | University of Agriculture Faisalabad | Published: October, 2026

✉ tafseermuhammad17@gmail.com | Position: Student

Introduction

In modern times, tech and AI etc. are not just tools, they have become proper companions, a teacher, a friend. As technology is rising rapidly, people are getting more involved in it and rely increasingly on it. People are using machines for many purposes and for every small move, where once human thinking was required. This important factor is called cognitive **offloading**, where students, researchers transfer their thinking and problem-solving responsibilities to external systems and machines.

In programming, most of the freshers and juniors follow this trend and they just rely on technology. Many novice and fresher developers now rely heavily on AI-assisted coding tools like open AI, Gemini, Claude to generate solutions. They do this for ease, for time saving .but this has a lot of impact on their thinking. Gradually their own thinking abilities start decreasing. We can say that it makes coding faster and more accessible, but it raises an important concern: are programmers still developing the ability to think critically and solve problems on their own?

"This shift is not just about writing code faster, it is about changing the way programmers think and learn."

The use of Artificial intelligence has been raised more than hundred percent as compared to the last 5 years. And for whom it is more concerning, into the daily fabric of university students, employees and every other chairperson. Five years ago there was nothing about artificial intelligence. People even didn't know the technology used and the more advanced features that are covering almost every aspect of life in today's time.

Learning and understanding of AI is not as easy and simple as we think using it. A student who knows well how a language model constructs a sentence, checks the limitations of algorithmic reasoning, and appreciates the ethical boundaries of AI-assisted academic work is in an extraordinary position from a person who simply pastes the sentence or paragraphs and copies the output.

"AI-assisted programming provides instant solutions but reduces cognitive engagement in learners.

Over-reliance on generated code can weaken critical thinking and debugging skills."

Cognitive Offloading in the Age of AI

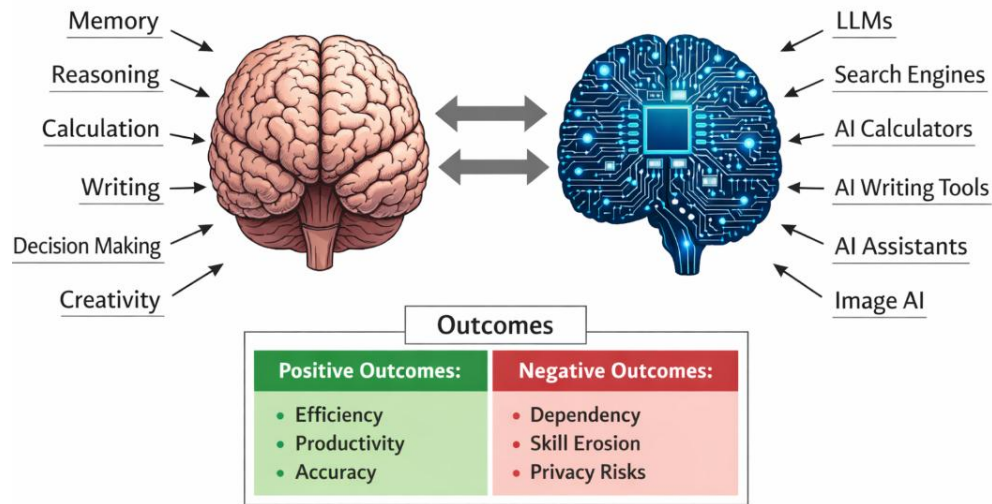


Figure 1: Cognitive Offloading Model in the Age of Artificial Intelligence

Technology Overview:

AI tools have reduced human thinking to some extent. They just focus on all the AI related tools from which they can get everything they want. Some tasks that remained unsolved for many hours, now can be solved easily within minutes.

Traditionally, learning programming involves:

- Problem-solving technique
- Logic building
- Error finding and debugging

These steps are fundamental in learning programming skills. These are three main skills that provide an efficient role in students' learning and mind growth. Beginners generally use AI assisted tools for their ease but skip many initial stages that prove life-changing techniques.

Key Finding and impact:

There is no doubt that AI tools play a significant role. They save time, solve complex problems in seconds, and help programmers to get more efficient results. What once took hours of manual effort can now be solved in no time.

However, this convenience causes a lot of disadvantages:

- Decreased independent thinking ability
- Increased dependence on AI tools and chat boots
- Weaker debugging and logical reasoning skills

From an industrial overview, companies prefer those who think independently and solve multiple tasks without AI as compared to those who use technology for their minimal uses and do not think independently. During interviews and technical assessments, candidates are often asked to demonstrate their logical reasoning and ability to approach unfamiliar problems.

This makes a huge difference between **AI productivity** and **human thinking**. **Developers** can make many sites in



no time by using AI tools but without those tools, this can take many days to months.

Universities that do research about AI dependency and make good models and chat boots, make analysis on yearly basis — rather than relying solely on detection software and penalty clauses — are likely to cultivate both stronger academic performance and stronger academic integrity. The two outcomes are not separate problems with separate solutions; the data suggest they share a common root in genuine understanding.

Future outlook:

As AI is getting more involved day by day, its role in programming and students etc is also getting intense. The challenge is not to avoid these tools, but to use them wisely.

But there must be an equal level for both. Programmers should use technology for their purposes but should not get more attracted to them. As it will only affect their own thinking. Use AI tools for a certain limit and use your own thinking. But if a programmer has no time and he has a lot to do then he can get help from AI and can depend on it.

In the outlook, the most powerful and creative programmers will be those who do not depend entirely on AI, not those who depend entirely on AI and cannot combine strong fundamental skills with intelligent use of technology. The students or employees that get the highest ranks in top global companies are not those who use tech tools for everything, but those who use it best: critically, responsibly, and with both its power and its limits. Building that comprehension is one of the most valuable things a university can do for its students today.

About the Author

Muhammad Tafseer is a student in the Department of Computer Science at University of Agriculture Faisalabad. Currently doing BS Software engineering 6th semester. His research interests include artificial intelligence in education and cognitive offloading environments. He focuses on understanding how modern tools influence learning, thinking, and skill development. He can be reached at tafseermuhammad17@gmail.com

Keywords:

Artificial Intelligence; Cognitive Offloading; Programming Education; Skill Development; Software Engineering

References

1. Sweller, J. (2023) Cognitive Load Theory and Learning Systems.
2. Norman, D. (2024) The Design of Everyday Thinking in Intelligent Systems.
3. Kirschner, P. A., & De Bruyckere, P. (2022) "The myths of the digital native and the multitasker," Teaching and Teacher Education.
4. Carr, N. (2020) The Shallows: What the Internet Is Doing to Our Brains.
5. Gerlich, M. (2025). AI tools in society: Impacts on cognitive offloading and the future of critical thinking. *Societies*, 15(1), 6.
6. Jose, et al. (2025). The cognitive paradox of AI in education: Between enhancement and erosion. *Frontiers in Education*.
7. Frontiers in Psychology. (2025). Cognitive offloading or cognitive overload? How AI alters the mental architecture of coping. *Frontiers in Psychology*.
8. Shum, S.B. (2024). Generative AI for critical analysis: Practical tools, cognitive offloading and human agency. *Joint Proceedings of LAK 2024 Workshops*, Tokyo, Japan, pp. 205–213.
9. Fan, Y., Tang, L., Le, H., et al. (2025). Beware of metacognitive laziness: Effects of generative artificial intelligence on learning motivation, processes, and performance. *British Journal of Educational Technology*, 56(2), 489–530.
10. Gesnot, R. (2025). The impact of artificial intelligence on human thought. *arXiv Working Paper*. arXiv:2508.16628