

Cognitive Scaffolding and Cognitive Offloading through Artificial Intelligence in Education

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Abstract

AI has become an integral component of educational practices, influencing how students' access and engage with knowledge. While AI offers significant benefits, concerns have emerged regarding its potential impact on students' cognitive development. This study examines the relationship between Artificial Intelligence (AI) perception and cognitive abilities among undergraduate students. Moreover, discussed the findings with theoretical framework. The study adopts a quantitative research approach using a survey method. A sample of 60 undergraduate students from St. Joseph College, Ukhrul was selected through simple random sampling. Data were collected using two standardized instruments. The collected data were analysed using Pearson's correlation coefficient. The findings reveal that the majority of students exhibit moderate to low levels of AI perception and cognitive abilities. The study highlights that the influence of AI on cognition is not inherently positive or negative but depends on the manner and purpose of its use. Excessive reliance on AI may lead to reduced cognitive engagement, while its appropriate use can serve as a supportive learning tool. Moreover, educational implications are also discussed. It concludes that AI should function as a supportive mechanism rather than a substitute for independent thinking and intellectual development.

Keywords: *Artificial Intelligence, Cognitive Scaffolding, Cognitive Offloading*

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Background of The Study

From the beginning of human civilization, change has been continuous, bringing us now to an era characterized by technology and intelligent machines. The significance of this transformation can also be simply understood through the lens of Boguslaw's cybernetic theory (Boguslaw, 1965) of social change. Boguslaw conceptualises society as a self-regulating system in which information flows, control mechanisms, communication, and feedback systems play central roles in the transformation and development of the system (society). Social change, in this view, does not occur randomly but develops through continuous interaction between individuals and the systems that organize their social groups. Technology accelerates this process by increasing the circulation of information and changing how control and adaptation happen, meaning society can respond to change more quickly, guided by digital structures. As artificial intelligence grows more embedded, we are entering a phase where human intelligence is increasingly supplemented by AI in many domains. It functions as a leverage mechanism to enhance productivity and innovation.

Scientific inventions have affected every aspect of human life, including daily activities; even our kitchens have become automated. Consequently, education too has been influenced by technology. The creation and accessibility of the internet have made almost everything possible to acquire at any time and place. Today, education can be incomplete without technology. The NEP- 2020 has focused on digital pedagogy, signalling a transformation in the structure and delivery of education (Ministry of Education, 2020). At the recent AI summit held in New Delhi in February 2026, Narendra Modi emphasized that India has the potential to become a global leader in Artificial Intelligence. He highlighted that AI can significantly transform key sectors such as education, healthcare, business, and agriculture, while stressing that its development should be human-centric, inclusive, and focused on empowering citizens through skill development and innovation (Press Information Bureau, 2026). Improving cognitive learning is a fundamental objective in education, as it plays a vital role in shaping students' academic success and overall intellectual growth. It not only promotes knowledge acquisition but also fosters the acquisition of higher-order thinking skills such as analysis, critical thinking, self-introspection, and decision-making. Furthermore, enhancing cognitive abilities enables learners to become more independent and adaptable in life, which is useful for both academic and real-life challenges.

AI Tools and Cognitive Abilities In Education

In learning, our brain must be put to work, meaning to activate our cognitive skills. However, with the availability and usage of AI tools, the question arises: Are

AI tools helpful to improve or decline the function of one’s cognition? AI-based tools are able to deliver instant information and provide personalised learning. The proper application of artificial intelligence can serve as a cognitive support system that enhances learners’ interaction with knowledge. On the other hand, the services AI tools can give to students, they might become overly dependent on the ease that AI provides. Moreover, it can also develop the so-called “Google effect” or “digital amnesia,” (Sparrow et al., 2011) where students tend to forget information by thinking that they can Google or simply ask AI chatbots later.

The primary aim of artificial intelligence is not just to enhance human cognitive abilities, but also to develop systems that can continuously learn from experience, adapt to new situations, and improve their performance over time (Brown & Johnson, 2020). AI- powered tools in education are opening up new ways to tailor learning to individual needs, adjust learning paths, and, moreover, make administrative tasks more efficient and manageable (Alfradi et al., 2024). There is a significant concern that excessive reliance on automated systems may lead to a gradual decline in students’ critical thinking abilities, ultimately impairing their capacity to produce original and innovative ideas (Johnson & Kress, 2019).

Theoretical Framework

1. Cognitive Load Theory suggests that individuals have a limited working memory to process new information. Therefore, instructional design should aim to reduce cognitive load. It also emphasizes the importance of mental effort directed toward learning, which is referred to as “germane load” in building lasting knowledge structures (Schemas) for long-lasting memory. In the context of AI, it simplifies to reduce unnecessary information to have easier learning and mental space and also can serve as an instructional support in helping learners until they can do the cognitive work independently.

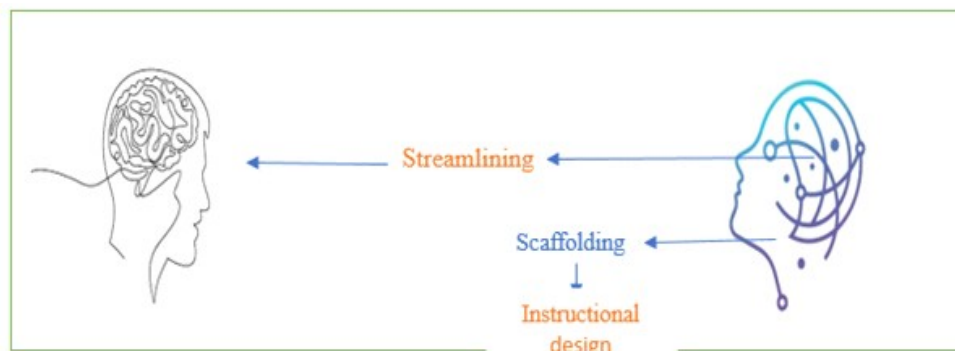
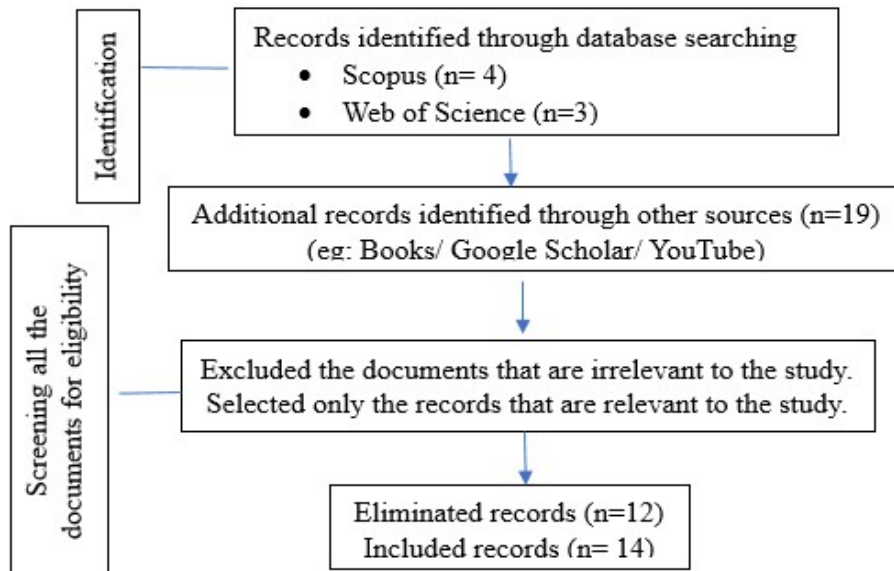


Fig.1: Role of AI in Cognitive Load Reduction

2. Constructivist Learning Theory emphasizes trial and error as a process of constructing knowledge. Example: AI provides feedback instead of direct answers until the learner reaches the correct solution.

Search Strategy



Rationale of The Study

In recent years, a growing number of empirical studies have examined how artificial intelligence influences students' cognitive learning outcomes. Although many studies have been written on the application of AI in education in India and abroad, comparatively fewer studies have been conducted in the state of Manipur. Thus, this paper is aimed at analysing the connection between AI and cognitive skills among the students of higher education, especially among undergraduate students. The study aims to make a contribution to the current debate on the possibilities of implementing AI in the educational process without compromising the cognitive skills that are necessary for one's intellectual growth and development.

Objectives of The Study

1. To examine the level of artificial intelligence perception among undergraduate students of St. Joseph College, Ukhul, Manipur.
2. To assess the level of cognitive abilities among undergraduate students.
3. To determine the relationship between artificial intelligence perception and cognitive abilities among undergraduate students.

Methodology: The present study adopted a quantitative research approach and employed the survey method to examine the levels of AI and cognitive abilities, as well as the relationship between students’ perceptions of Artificial Intelligence and their cognitive abilities.

Sample and Sampling Technique: The study was conducted on a sample of 60 undergraduate students selected from St. Joseph College, Ukhurul. The respondents were chosen using a simple random sampling technique, ensuring equal opportunity for participation. Out of the total sample, 28 respondents were male and 32 were female.

Tools

For the present study, two standardized tools have been employed. To examine students’ perceptions of artificial intelligence, the Artificial Intelligence Scale developed by Ms. Samreen Beig and Dr. Syed Hasan Qasim has been used. In addition, students’ cognitive abilities have been assessed using the Productive Thinking Scale developed by Dr. Anu Balhara and Mrs. Priya Mittal.

Statistical Techniques Used: The collected data were analysed using appropriate statistical techniques: Pearson product-moment correlation coefficient (r) to examine the relationship between Artificial Intelligence perception and cognitive abilities

Data Analysis & Interpretation

Table No. 1. Level of Artificial Intelligence Perception

Level Category	n (total no. of students)	%	Cumulative %
Extremely High	3	5.0	5.0
High	2	3.3	8.3
Above Average	9	15.0	23.3
Average	14	23.3	46.7
Below Average	12	20.0	66.7
low	12	20.0	86.7
Extremely Low	8	13.3	100.0
Total	60	100.0	

Interpretation

The Table No.1. shows the distribution of the undergraduate students according to their level of perception of artificial intelligence Most respondents fall within the average level (23.3%), followed by below average (20.0%) and low

(20.0%). A moderate proportion of students (15.0%) falls under above average level. Only a small percentage of respondents fall into the high (3.3%) and extremely high (5.0%) levels. Overall, the distribution reflects that students' perception of artificial intelligence is mostly moderate to low, suggesting limited understanding of AI concepts.

Table No. 2. Level of cognitive abilities

Level Category	n (total no. of students)	%	Cumulative %
Extremely High	8	13.3	13.3
High	6	10.0	23.3
Above Average	9	15.0	38.3
Average	7	11.7	50.0
Below Average	11	18.3	68.3
Low	16	26.7	95.0
Extremely Low	3	5.0	100.0
Total	60	100.0	

Interpretation

Only 38.3% (cumulatively) of students fall within above average to extremely high levels, whereas 50.0% fall within below average to extremely low levels. This indicates that student's cognitive abilities are mostly at lower levels.

Table No. 3: Correlation between Artificial Intelligence level and Productive Thinking level

Pearson product-moment correlation		Artificial Intelligence	Productive Thinking
Artificial Intelligence	Correlation Coefficient	1	-.155
	Sig. (2-tailed)		.237
	N	60	60
Productive Thinking	Correlation Coefficient	-.155	1
	Sig. (2-tailed)	.237	
	N	60	60

Significant at .05 level

Interpretation

The data show a weak negative relationship between AI Level and PT Level ($r = -0.16$), Moreover, the correlation is not statistically significant ($p = .237 > .05$),

meaning that there is no significant relationship between the two variables. Therefore, null hypothesis is accepted.

Major Findings:

1. The majority of undergraduate students demonstrate average to low levels of AI perception, with more than half (53.3%) falling below average. Only a small proportion has a high level. In other words, only a few have an advanced understanding of AI.
2. It has been found that Cognitive abilities are skewed toward the lower spectrum, with 50% of students categorized as below average to extremely low. And only 38.3% fall in above-average to high levels, which means fewer students have good cognitive abilities.
3. The findings also indicate that a weak negative correlation ($r = -0.155$) exists between AI perception and cognitive abilities, suggesting that higher AI perception is slightly associated with lower cognitive ability.

Discussions

The findings of the present study reveal that the relationship between students' perception of Artificial Intelligence and their cognitive abilities is negative, weak, and statistically insignificant. However, the slight negative relationship of the two variables may reflect the concept of **cognitive offloading**, where individuals rely on external tools to reduce mental effort. In the context of this study, students may be using and relying on AI system rather than engaging in mental processing to support their learning. This behaviour aligns with the concept of "digital amnesia," where learners tend to depend on technology for storing and retrieving information instead of learning by heart. Over time, such patterns may influence the depth of cognitive engagement in areas like critical thinking and problem-solving.

From the perspective of **Cognitive Load Theory**, the findings suggest that students may not be effectively utilizing AI to enhance "germane load," i.e., deep learning. Instead of using AI to deepen understanding, there is a possibility that students are using it to minimize effort by choosing the ready-made context and an easier way to learn, rather than going through the complex cognitive processes. While AI has the potential to reduce extraneous load and streamline learning, its misuse may lead to superficial engagement with content. Similarly, when viewed through the lens of **Constructivist Learning Theory**, the role of active engagement becomes essential. If students increasingly rely on AI-generated answers, they may lose opportunities to struggle with problems and make mistakes to find out answers; these steps are crucial for cognitive growth.

Another important dimension to discuss is the overall distribution of both AI perception and cognitive abilities among the respondents. The study indicates that there are overall low levels of both AI perception and cognitive abilities, suggesting that students are not yet competent users of Artificial Intelligence tools, nor are they fully developed in higher-order thinking skills. With the findings, the central idea is that the impact of AI on cognition is not automatic but highly dependent on how it is used. AI can either act as a powerful cognitive scaffold or as a shortcut that limits intellectual effort. Therefore, the issue is not the presence of AI, but the nature and purpose of its integration into the learning process.

Educational Implications

- i. **AI Literacy:** The need for AI literacy extends beyond basic skills to include a deeper understanding of how AI systems function, their limitations, and, most importantly, their ethical use. Equipping both students and educators with this literacy enables them to engage with AI productively.
- ii. **Enhanced Cognitive Engagement:** Educators should adopt pedagogical strategies that require students to justify their answers and also to check if the students are writing the AI-generated information. In this way, learners can benefit from AI without compromising the development of essential cognitive skills.
- iii. **Balanced Integration of AI as a scaffolding tool:** The study reinforces the idea that AI should function as a scaffolding mechanism that supports. Educators must ensure that AI integration is balanced and purposeful. By maintaining this balance, AI can enhance learning efficiency while preserving cognitive rigor.
- iv. **Strengthening Ethical and Academic Integrity Frameworks:** The increasing use of AI in academic work raises significant concerns regarding academic integrity and ethical practices. Hence, it is necessary for clear ethical guidelines for the use of AI in education. Students should be trained to use AI as an assistive tool while maintaining ownership of their learning.
- v. **Capacity Building for Educators:** The role of educators becomes even more crucial in AI-integrated learning environments. Without adequate teacher preparedness, the potential benefits of AI in education may not be fully realized. Therefore, AI literacy must begin with educators and institutions so as to utilize AI in the most productive and ethical way.
- vi. **Bridging the Gap between AI use and Cognitive Development:** The study reveals that both AI perception and cognitive abilities are relatively low

among students. This indicates a gap between the two. Addressing this gap requires a holistic approach that combines technological access with pedagogical innovation. Educational systems must focus on aligning AI usage with cognitive development goals.

Conclusion

The present study provides a nuanced understanding of the relationship between Artificial Intelligence and cognitive abilities among undergraduate students. Too much AI in the academic odyssey could deteriorate one's cognition. With the emergence of artificial intelligence, learners adopt AI's patterns and algorithms rather than creating their own mind maps to learn. This behaviour contradicts the learning theories discussed. Moreover, the study shows that the mere presence of AI in educational settings does not guarantee improved learning outcomes. Instead, the effectiveness of AI in learning depends on users' awareness. It is important to know that the benefits can be realized only when AI is integrated in education thoughtfully, with a clear intention to enhance one's cognitive development. With the right digital literacy and skills, the pedagogy of teaching and learning can be carried out at a top-notch level.

Therefore, we can conclude that Artificial Intelligence in education is not directly or entirely responsible for either enhancing or decreasing one's cognition. That learning does not depend on AI. Yes, it has a role that could be both positive and negative. However, the outcomes of learning are determined by the qualities of learners, including their moral and human values. The takeaway of this paper is that one must not compromise the ethics of learning with the convenience of accessibility of artificial systems and automated generations to replace their original skills, but rather use AI wisely to become a wiser person.

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