

THE IMPACT OF ARTIFICIAL INTELLIGENCE ON STUDENTS' COGNITIVE PROCESSES: A STUDY OF MEMORY AND INDEPENDENT THINKING IN EDUCATIONAL CONTEXTS

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Abstract

In the digital era, technology plays a crucial role in every field, especially in education. Using artificial intelligence is given as a great example of it. Many students do not know how to use artificial intelligence, for example, ChatGPT, Gemini, DeepSeek, Gamma, Learn AI, effectively for their studies. Some students use it as their slave and do their homework, asking everything for whatever is necessary and interesting for themselves. Others use it as a teacher. If they have any unknown questions, they will discuss and broaden their horizons by training with artificial tools. Mainly, the key purpose of the author analyses the influence of AI on a student's memory skills and neural systems. In this research other scholars will learn about encoding information, followed by storage and retrieval in the memorization process, and some techniques for memory improvement by using AI tools, and what the correlation is between the nervous system and artificial intelligence. The author used mixed methods, particularly the qualitative research method and the quantitative research method, by using focused-group interview and observation methods. The author interviewed university students, mainly choose 3 sophomore classes from particular university, about how to use digital tools (artificial intelligence) in their studies. By asking such questions: What are the advantages and disadvantages of AI usage in the learning process? How can we keep all the information in our memory? What are the mnemonics? Why do we need good memory in education? The result of this research showed that almost 70% of students use AI tools in their learning process. While around 20% of participants perceive AI as mostly beneficial, the majority (57%) confirmed its negative effects on memory, critical thinking, and learning behaviour. Ultimately, these results suggest that teacher's supervision and parental control may have a major influence on AI usage in an effective way. In addition, it depends on students how to use it. Like the writer mentioned above, if students have a passion for a particular thing, they may search for new information and details in this sphere through the beneficial use of AI.

Keywords: Artificial tools, neural systems, encoding information, machine learning, personalized learning, memorization process, parental control, student engagement.

Introduction

Nowadays, people cannot imagine their lives without technology. Luo Yating (2023) states that modern technology and education are combined; therefore, it moves forward the educational teaching methods. Also, in the dedication of the AI conference (UNESCO, 20 April 2023), neurosciences emphasized that using Artificial Intelligence makes easier to learning process and is able to resolve the learning challenges. Making use of AI tools enhances educational fields by creating new and contemporary teaching systems. These systems can change the cognitive processes and emotional processes of students by giving immediate feedback. Students take a chance to use more online apps such as, ChatGPT, Gemini, DeepSeek, Gamma, Lerna AI, and AI Tutor to increase their language learning skills. Quizlet, Kahoot, Wordwall, and Spinner are types of online games, and they are proper for all fields of education to improve knowledge. Using such kinds of apps and games boosts student engagement and involvement. According to Zhao Shuai (2023), “Applying the use of AI in the realm of education is increasing day-by-day, so the teaching system is showing a significant improvement.” Using digital tools in the field of education assists students in many ways. For example, AI can check the students' level and provide them with suitable content, and it also gives quick and reliable feedback for improvement. When students begin learning from a level which is the same as a student's level, it gives access to students to learn effectively without some mental and psychological challenges. It positively influences the students' memory and neural system. A spokesperson for Sciences Po told Reuters (2023) demonstrates that using Artificial Intelligence (ChatGPT) is not helpful and beneficial all the time. Some spheres of ChatGPT have been mysterious for researchers and scientists, who try to raise people's attention while usage of AI. “ChatGPT never makes a positive contribution instead of helping, it can destroy system of teaching, because of relying on artificial tools (ChatGPT), the cognitive dependancy increase among majority students” said Noam Chomsky who is a public intellectual known for his work in modern linguistics, in an interview (EduKitchen & January21, 2023). Students have to know how to prompt or ask for help before using artificial tools in a beneficial way. If they do not follow this rule, they may face some challenges and difficulties while working with them. For example, ChatGPT is an advanced AI chatbot to explore ideas, solve problems, and learn faster. When students overrely too much on AI for answers, their ability to memory recall decline. Also, it stops to think independently. Another example is Lerna AI which supports personalized and adaptive learning by adjusting content to each student's ability level. Overuse of it can shorten attention span

and create cognitive dependency, limiting the development of problem-solving and decision-making neural networks.

LITERATURE REVIEW

Artificial Intelligence and the educational process

Artificial Intelligence has appeared in the field of education since 1960 (HackerNoon, 2024). The first program of AI was used at Stanford University in 1965. It was called PLATO, which is Programmed Logic for Automated Teaching Operations. The aim of this program was to teach students the basic knowledge of mathematics and science (Robert F. Smith, 2024), but it was not programmed fully, and they had no access to use it properly. Intelligent Tutoring System (ITS) was the second AI program, which is specialised for teaching geography, that was designed from the 1970s to the 1980s. From the mid-2000s, adaptive learning platforms, such as DreamBox and Knewton, became common. In the 2020s, artificial intelligence shows a rapid increase of demand in education because of a wide range of advantages. During this period, a release of ChatGPT gives learners access to generate text, check writing tasks, and get answers with explanations for each question and a speaking function (HackerNoon, 2024). After the creation of ChatGPT, Gamma, Learna AI, DeepSeek, and Gemini were invented step-by-step. They are all used in education and also specialised for different tasks. In recent years, AI has gained importance in education by supporting personalised learning, improving instructional efficiency, and helping students develop competencies required in a rapidly changing technological world (Dr Xandra, 2024). Moreover, AI contributes to decreased teacher workload through automated grading and instructional planning, while enhancing student engagement by offering constant and prompt feedback (Anthropic, 2025).

Artificial Intelligence and students' memory

Artificial Intelligence is increasingly pivotal not only in the field of IT management but also in education. Particularly, there are both pros and cons of AI in students' memorisation process. Artificial Intelligence provides students with personalised tutoring that works 24/7, and it gives immediate feedback, and also it uses interactive methods based on students' levels and gives simultaneously practical tasks for better understanding and transferring learned information from short-term memory to long-term memory (Ch. Pappas, 2024). Retrieval practice, which is a learning technique by recalling or remembering information, not by re-reading again (A. Sood, 2025), and spaced learning, which is a learning method where learners review the information at planned intervals (Wikipedia), are good options with AI tools. At that time, AI can be used to generate theme-related quizzes, flashcards or tests. However, the negative impact of artificial intelligence will be higher if students do not have enough knowledge of how to use it effectively. Majority learners overly rely on using digital tools, particularly ChatGPT, due to the convenience of instant access to information. This dependency leads them to become lazy

and reduces the need for independent effort, which may encourage passive learning habits. As a result, students' productivity, critical thinking and problem-solving skills can gradually decline (A. M. Vieriu & G. Petrea, 2025). Without proper guidance, excessive use of such kinds of tools may limit learners' cognitive development. Although AI can help memory retention, more research is needed to understand its influence on the deeper cognitive and neural processes involved in learning (Sparrow, B. Liu, J. and Wegner, D.M. 2011).

Neural system and cognitive process

The neural system is a complex network of neurones that receive and send signals to different parts of the body. The nervous system includes the brain, spinal cord, and a complex network of nerves spreading throughout the body. Besides regulating only breathing, heart rate, blood pressure and digestion functions, it can control thinking, memory, emotions and movements (2016, August 19). When it comes to cognitive processes, it is the way the brain understands and uses information from the world around us. It assists learners to think, learn, remember and solve problems. This process is always active, whether students are remembering a theme or making a decision (U. Neisser, 2025). For understanding the work of cognitive processes in the brain, we need to pay attention to the influence of short-term and long-term memory and also how digital devices can support these processes. Short-term memory holds information for a short time in the prefrontal cortex, while long-term memory stores it more permanently in the hippocampus, with attention and working memory acting as limits (Priya R. 2023). AI tools can help these brain processes through retrieval practice, spaced repetition, gamified activities, and interactive exercises, improving memory, focus, and engagement. But relying too much on AI can reduce thinking effort, weaken problem-solving skills, and limit independent learning, so it should be used carefully.

Identifying unexplored areas of research

Although previous studies have analysed the use of artificial intelligence in education, most researchers focus on quantitative outcomes, for example, academic performance and learning in an effective way. However, they did not fully explore the influence of AI on students' memory, cognitive development and learning styles. To address this gap, this research uses both qualitative and quantitative research methods, particularly focused-group interviews and classroom observation, with the aim of examining the real experiences of students with AI-supported learning. This approach makes it possible to gain a more detailed understanding of the impact of AI on students' memory and cognitive processes.

METHODOLOGY

Significantly, the study displayed that mixed research methods, combining qualitative and quantitative approaches, are highly productive to gain a comprehensive understanding of the impact of artificial intelligence on students' memory and cognitive processes. In particular, the author used focused-group interviews and observation of 75% of correspondents. The participants of this study included 30 university students who studied at Uzbekistan State World Language University, all of whom actively use AI tools in their learning activity. This study was guided by the following research questions: What are the advantages and disadvantages of AI usage in the learning process? How can we keep all the information in our memory? What are the mnemonics? Why do we need good memory in education?

The data were collected through focus-group interviews and classroom observation. Focus-group interviews were conducted to explore students' perceptions, experiences, and attitudes toward AI-supported learning. Classroom observation was conducted to examine students' learning behaviours, levels of engagement and cognitive involvement during AI-assisted tasks. Qualitative data were analysed using thematic analysis to identify common patterns and themes, while quantitative data were used to support the qualitative findings. In addition, ethical considerations were taken into account, and participants were informed about the purpose of the study. Their participation was voluntary, and confidentiality was maintained throughout the research process.

FINDINGS & DISCUSSION

The findings of this research taken by combined analysis of focus-group interview and observation methods. The focus-group interview was taken by three sophomore classes, which have been conducted among students of Uzbekistan State World Language University. These three classes remained anonymous and called such Class A, Class B, and Class C. Importantly, the focused-group interview was taken with the help of teachers, because researcher was observer and took some notes for paper. Before the beginning of the interview, teachers gave their students proper guidance and basic information about research. Focused-group interview and observation took about 50 minutes. In addition, all three classes consist of 10 voluntary students. In this part the author will give detailed information:

CLASS A:

In this class, during observation, students felt free to answer and active during tasks. Because around 80% of the participants completed the tasks independently, which indicates that they did not rely much on AI tools. In addition, approximately 90% of students were able to connect new information with their prior knowledge. A smaller group of students (about four participants) used note-taking and memorisation strategies to support their learning. The focus-group interview results also reflect a balanced view of AI.

About 30% of students pointed out the advantages of AI in education, while 50% of participants considered AI as a helpful but limited tool. The remaining 20% pointed out its negative effects, particularly increased dependency and reduced thinking ability. Class A showed a healthy use of Artificial Intelligence, not dependent. Their memory and thinking skills were so active.

Class A – Combined results chart			
Category	Focus-Group Interview Result	Observation Result	Final Interpretation
AI usage	Students reported moderate and purposeful use of AI tools	Limited active use observed	AI is used as a support tool rather than a primary source
Independent learning	Students claimed they try to learn on their own	Majority (80%) solved tasks independently	Strong independent learning behaviour
Memory	Students mentioned memorisation depends on importance	Around 40% took notes and attempted memorisation	Partial use of memory strategies
Attention	Students described active engagement	Most students remained attentive during tasks	Good concentration level
Understanding	Students believed AI helps understanding	Students relied more on their own ideas	Preference for self-learning
Collaboration	Students reported discussion with peers	Active peer discussion observed	Strong collaborative learning
Cognitive Impact	Mixed opinions (both benefits and limitations)	High connection with prior knowledge (90%)	Healthy cognitive engagement

CLASS B:

During observation, approximately half of the students thought and answered the question on their own. Compared to Class A, 35% of Class B students check their answers with the AI tool (ChatGPT). A minimum number of participants used the note-taking strategy. While the question was given out, many students read it aloud and tried to get the meaning of the question. Then asked ChatGPT for the purpose of checking their points of view. When the interview started, most of the students gave AI-given responses. Additionally,

one of the students explained that because of using ChatGPT every day, he addictively depended on it. That is why he gave the memorised ideas from AI tools. Also, the majority of students highlighted the disadvantageous outcomes of AI, about 70% of correspondents. They counted the several concerns of AI. Firstly, AI reduces independent thinking and increases dependency. Secondly, memory becomes weaker and rises with the disease of Alzheimer's. Thirdly, much use of AI leads to losing concentration and focus while studying. Finally, it is not trustworthy for sharing privacy and security. Despite this awareness, many students continued to use AI tools regularly and showed a high level of reliance on them. Class B demonstrates a clear gap between students' understanding of AI's disadvantages and their actual learning behaviour.

Class B – Combined results chart			
Category	Focus-Group Interview Result	Observation Result	Final Interpretation
AI usage	Frequent use	High usage observed	High reliance on AI
Independent learning	Mixed opinions	50% attempted tasks independently	Partial dependence
Memory	Short-term memory	Almost no note-taking	Weak memory retention
Attention	Generally focused	Mostly attentive	Passive attention
Understanding	AI helps learning	About 65% showed understanding	Surface-level comprehension
Collaboration	Discussed	Active peer discussion	Good collaborative interaction
Cognitive Impact	Negatively effect (dependency, reduced thinking)	Mostly rely on AI	Reduced cognitive engagement

CLASS C:

According to observation, only 10% of students thought independently, while about 90% of students relied on AI's response. This class's students had a low comprehensive check. Because 60% of students were distracted easily by social media and other platforms during the interview. Also, most of the students have a negative view toward the use of AI tools in education. The participants mentioned loss of thinking, memory problems, and over-dependency after long-term use of AI. This class was slightly different from others. During the focused-group interview, they needed to discuss given questions with their partners, but they divided into two groups and shared what they learned from each other after the

small discussion with their peers. The first group participated actively, and they created a different question related to AI. On the other hand, the second group were sometimes off-topic and talked about their daily routine, habits, and perfumes. Besides, the second group had a little focus on the tasks. Class C students showed a high level of dependency on AI tools and often relied on memorised responses instead of generating their own ideas, which may negatively influence their memory and attention during learning.

Class C – Combined results chart			
Category	Focus-Group Interview Result	Observation Result	Final Interpretation
AI usage	Very high use of AI tools	Around 90% of students used AI	Strong dependency on AI
Independent learning	Very low level	Only about 10% worked independently	Limited independent thinking
Memory	Weak memory reported	No note-taking; reliance on memorised answers	Poor long-term memory engagement
Attention	Negative impact noted	About 60% of students were distracted	Low level of focus
Understanding	Mixed views	About 90% completed tasks	Quick but surface-level understanding
Collaboration	Active participation	Students discussed answers with peers and with group	Presence of social learning
Cognitive Impact	Strong negative effects reported	Observations support interview responses	High cognitive dependency on AI

Several scholars, such as Zhao Shuai (2023), Luo Yating (2023), and Christopher Pappas (2024) assert the positive role of AI in improving learning through personalised support and immediate feedback. This is consistent with the results from Class A, that students used AI in a balanced way and maintained strong independent learning and active cognitive engagement. However, the findings also demonstrated the concerns raised by Reuters (2023), Vieriu and Petrea (2025), and Sparrow et al (2011), who argue that overreliance on digital tools may weaken memory and critical thinking. In Class B and Class C, students declare high dependency on AI, reduced independent thinking, and weaker

memory retention, which directly supports these views. Although many students were aware of negative effects of AI especially in Class B and C, they continued to rely on it. This suggests that awareness is not enough to change learning behaviour. The study shows that AI can be beneficial, but only when used in a controlled and thoughtful way.

CONCLUSION

This research aimed to explore the significance of artificial intelligence (AI) in shaping students' memory and neural system in the field of education. The primary objective of this paper was to better understand how AI-based tools influence the way students learn, especially in terms memory retention, cognitive engagement, and brain processes involved in studying and understanding information. The findings of this article show that almost 70-75% of representatives confirm that AI has a complex role in education because it brings both benefits and challenges. On the one hand, AI has proven to be a useful supportive system for students. Contemporary AI-based tools, such as intelligent tutoring systems and adaptive learning platforms, help students learn more effectively. These tools can adjust the difficulty level of content based on the learners' needs, provide immediate feedback, and offer many practical activities, which contributes positively to cognitive development and enhances memory retention. On the other hand, some concerns about AI are mentioned in this study. One of the main problems is overdependence on AI. This leads to weaker critical thinking skills and decreases the level of active learning. From a neuroscientific perspective, learning requires active brain involvement, particularly in areas which are related to attention, reasoning, and memory formation. If students become passive learners, these brain processes may not be fully activated, which can negatively affect the long-term memory process. Taking everything into account, it is important to use AI in a balanced and controlled way. AI is better understood as a tool that supports learning, not something that replaces human thinking. Teachers also have an important role in helping students use AI tools in a proper way. They guide learners to think more deeply, look at information carefully, and ask their own questions. With this kind of support, students can use technology effectively while still developing their abilities and strengthening their brain functions.

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