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The Negative Impact of Artificial Intelligence (AI) Usage on Landscape Architecture Students' Memory Retention and Information Retrieval

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ABSTRACT

Despite the trending AI-usage surge phenomena, over 90% of lecturers in several Malaysian universities reported never receiving any training or guidance on incorporating generative AI tools into their teaching methods. Research trends from 2022 until 2026 indicated that most users had engaged with an AI chatbot daily and there is no sign that it will be halted soon. Lecturers are now exploring new techniques, such as using AI, to deliver lessons. But, research on how the use of AI can enhance student's lesson retention in memory is still underexplored. Therefore, this study investigates the impact of AI towards students' memory retention and retrieval among landscape architecture students. The study included 63 respondents, comprising lecturers and students from diverse backgrounds within the landscape architecture program. Survey data were evaluated using descriptive analysis, while the recorded verbal and non-verbal responses were analyzed thematically. The findings suggest that AI usage not only hinders student's memory retention but also information retrieval, leading to superficial learning and exacerbating the Ebbinghaus Forgetting Curve. In conclusion, when answers are too easy to find, students lose the vital practice of deeply processing and recalling information on their own, hence, AI tools can accidentally fuel student inattentiveness.

Keywords: Artificial Intelligence, Landscape Architecture Students, Memory Retention, Information Retrieval

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INTRODUCTION

Recent trends from 2022 show that approximately 88% of users had interacted with an AI chatbot, indicating their acceptance and integration into their daily routine experiences (Fokina, 2024). During late 2022, ChatGPT was introduced (Open AI, 2022). The launching had created an

AI-usage surge phenomena among people, especially students. The trend continued into 2023, with predictions of even greater usage and sophistication in AI chatbot technology across various sectors, including e-commerce, healthcare, and education. According to Masukume (2024), there is an increasing trend of integration of AI generated text in scientific articles. Similarly, He and Bu (2026) reported the integration of generative AI into academic writing is rapid and cannot be halted in the near future. Despite the popularity of AI, a study showed that more than 90% of lecturers in the Faculty of Built Environment and Surveying at Universiti Teknologi Malaysia (UTM) reported that they had never received any training or guidance on using generative AI in their teaching delivery. However, to produce future-ready graduates, learning AI is inevitable. To ensure the net benefit to society and the education sector, lecturers need to fully harness AI while minimizing ethical concerns and negative impacts on the students' learning process (Ray & Ray, 2024; Saylam et al., 2023).

AI software has been widely promoted to support learners at all levels, particularly students, in improving their learning outcomes. However, the extent to which this technology enhances students' learning experiences remains uncertain. Notably, there is a gap in understanding the impact of generative AI on students' memory retention. Several questions were formulated such as a) To what extent is the use of AI tools during in-class activities associated with students' immediate recall and levels of engagement?; b) How do lecturers perceive the impact of AI tool integration on student engagement and the overall dynamics of the classroom?; c) What are students' perceptions of their lecturers' teaching styles, and what emotional responses do they experience regarding AI integration in the classroom?: and d) What are the primary challenges and obstacles lecturers encounter when attempting to integrate AI into their teaching practices? Therefore, this study aims to investigate the impact of Artificial Intelligence on Landscape Architecture Students' memory retention and information retrieval.

LITERATURE REVIEW

Students being forgetful is attributed to the Ebbinghaus Forgetting Effect, where learned information is gradually lost over time (Fortino & Lowrance, 2019). The Ebbinghaus's Forgetting Curve diagram illustrates (Figure 1) how quickly one can forget newly learned information over time without reinforcement, showing that approximately 50% of information is forgotten within an hour and about 70% within 24 hours (Fortino & Lowrance, 2019). In the context of landscape architecture students, when AI image generators are used to instantly conceptualize spaces, they bypass the physical act of drawing. Without this tactile engagement, the students fail to internalize an intuitive understanding of scale, topography, and human movement, leaving their retrieval pathways too weak to sketch or adapt designs spontaneously on a job site. Therefore, when AI provides immediate answers or solutions, students may not need to exert mental effort to process and encode information, leading to weaker memory traces and faster forgetting.

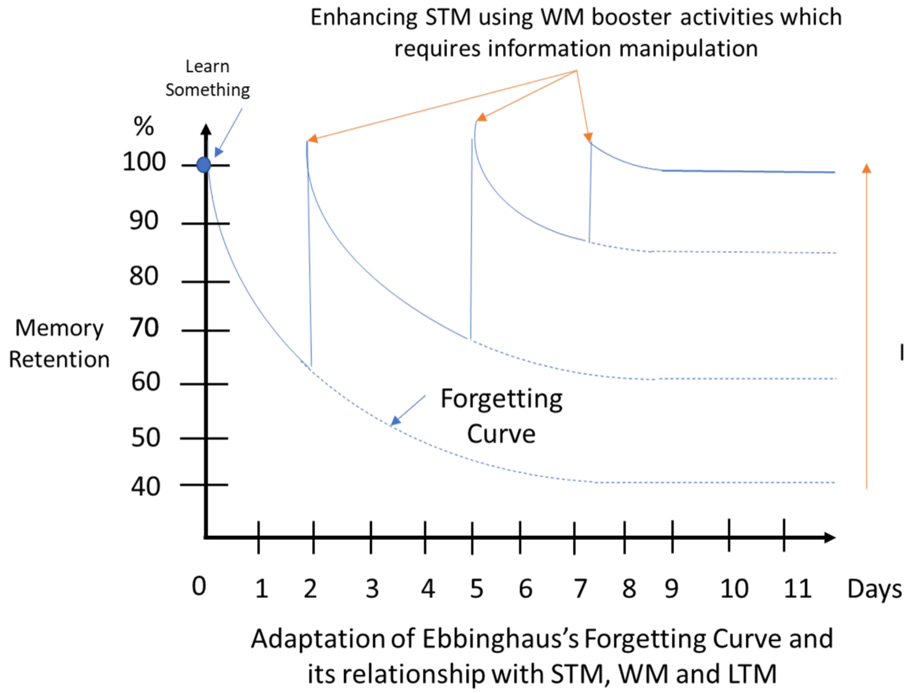


Figure 1. The Ebbinghaus's Forgetting Curve relationships with Short-Term Memory (STM), Working Memory (WM) and Long-Term Memory (LTM)

Figure 2 shows the adapted diagram illustrates how the rapid consumption of fast, AI-generated content actively exacerbates the natural Ebbinghaus Forgetting Curve. While the light blue curves demonstrate that deliberate practice and working memory manipulation can successfully solidify knowledge into robust LTM, the red "Intervention Point" highlights the cognitive danger of shifting to high-speed information consumption. When overwhelmed by a constant, swift stream of AI output without adequate pauses, the brain is forced into shallow processing. This continuous information overload disrupts proper memory consolidation, causing the retention rate to plummet along the jagged red trajectory. Ultimately, instead of flattening out into lasting knowledge, the learning process is undermined, resulting in fragile, fragmented memory that rapidly decays.

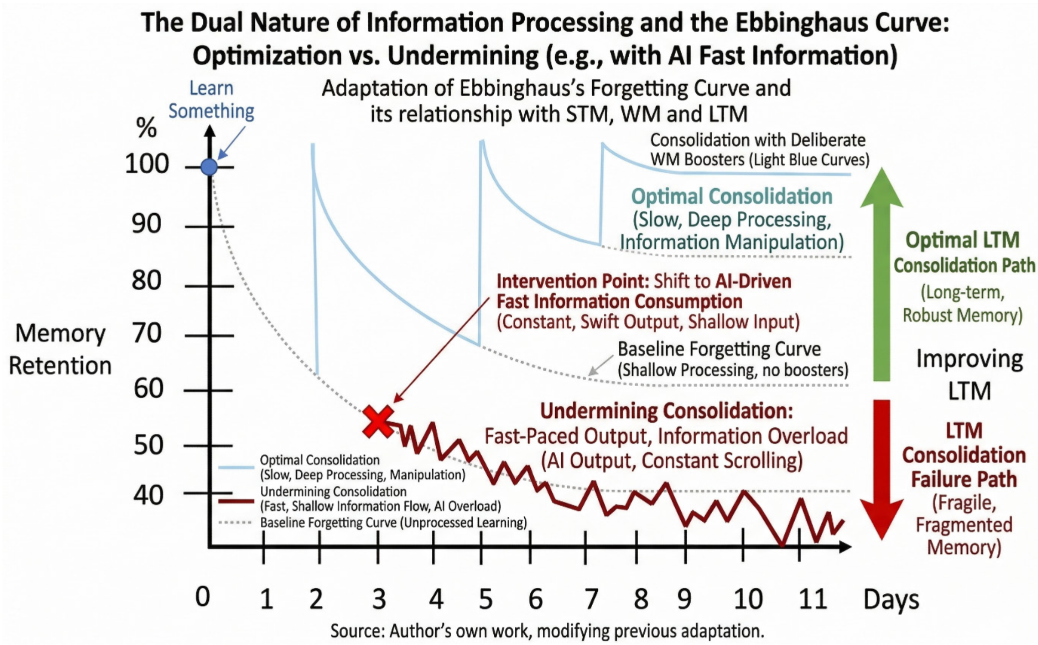
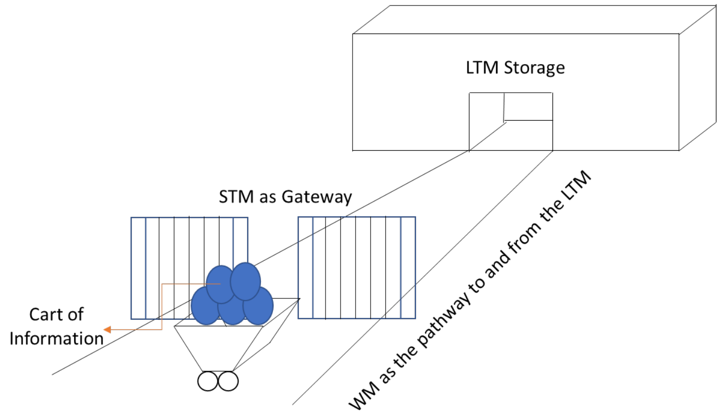


Figure 2. The intervention of AI usage worsens the Ebbinghaus's Forgetting Curve

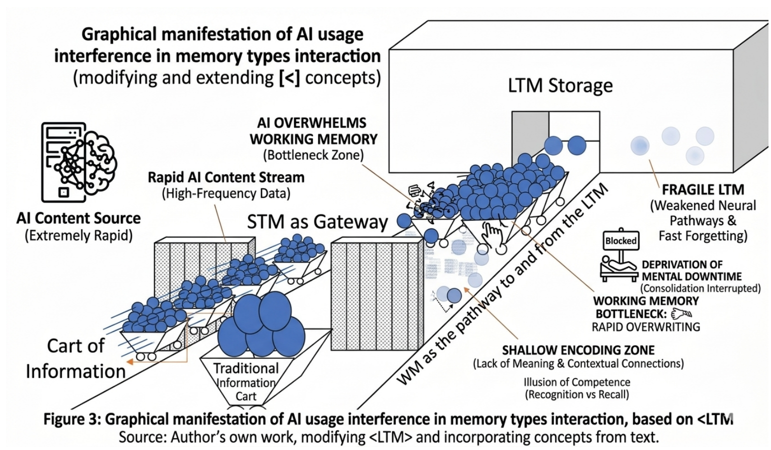
Mental Process Mechanism

There are three types of memory that are responsible for one to remember and recall information, namely Short-Term Memory (STM), Working Memory (WM) and Long-Term Memory (LTM). Information enters STM through sensory inputs or retrieval from LTM. STM has a limited capacity and duration, but it is necessary for conscious awareness and initial processing of information (LaRocque et al., 2014). If information in STM is rehearsed or associated with existing knowledge in LTM, it is more likely to be transferred to LTM for long-term storage. This process is known as encoding, and it involves creating a lasting memory trace. WM plays a crucial role in facilitating the transfer of information from STM to LTM (Nie et al., 2019). It allows individuals to actively manipulate and process information, making connections with prior knowledge stored in LTM. This active engagement enhances the likelihood of successful encoding and long-term retention. Once information is stored in LTM, WM enables its retrieval and use in various contexts. WM retrieves relevant information from LTM, allowing individuals to apply their knowledge to problem-solving, decision-making, and other cognitive tasks. The interplay between STM, LTM, and WM is essential for effective learning, memory formation, and cognitive functioning. These memory types interact (Figure 3) as such, STM serving as a gateway to LTM, and WM facilitating the use of information from both. Understanding these memory systems and their interactions can inform lecturers how to enhance or discourage memorization.



Source: Author's own work
Figure 3. Graphical manifestation of traditional memory types interaction, namely STM, WM and LTM.

Figure 4 illustrates the cognitive bottleneck that occurs when the brain is subjected to a rapid stream of AI-generated content. Unlike a traditional (Figure 3), moderately paced "cart of information," the high-frequency data from an AI source floods the STM gateway and overwhelms WM. Because working memory has a strictly limited capacity, this barrage of fast information causes rapid overwriting, preventing the brain from deeply processing or attaching meaningful context to the new data. This creates a "shallow encoding zone" where users might experience an illusion of competence, recognizing the information in the moment but failing to actually learn it. Furthermore, because this constant stream deprives the brain of essential mental downtime, the normal consolidation process is blocked. The end result is that the information either fails to reach LTM storage altogether or forms only a "fragile LTM," consisting of weakened neural pathways that are quickly forgotten.



Source: Author's own work
Figure 4. Graphical manifestation of AI usage interference in memory types interaction STM, WM and LTM.

Teaching Techniques that Enhance Memory

Notably, students' study habits play a crucial role in information retention. The effect of not review learning materials regularly, leading to poorer recall before exams compared to in-class initial presentation (Westman & Lewandowski, 1991). To address this issue, lecturers should focus not only on improving presentations and teaching specific learning skills but also on instilling effective study habits to enhance long-term retention and recall of academic content (Westman & Lewandowski, 1991; Fortino & Lowrance, 2019).

According to Irman (2019), mind mapping techniques in counseling have shown effectiveness in improving students' ability to remember lessons. For slow learners in elementary schools, mnemonic techniques such as acronyms, acrostics, chunking, loci, rhyme, and keywords have been identified as helpful memory aids (Simbolon et al., 2022). These studies suggested that a combination of several approaches, including experiential learning, visual aids, and memory techniques, are effective in helping students retain cumulative lessons. Till to date, many academic institutions, such as schools or universities, were seen to have a visible gap in teaching style to achieve desired outcome. Many lecturers were trained to deliver lessons according to these effective teaching and learning theories and techniques. However, how far they have achieved the knowledge transfer to students is still questionable. Therefore, this study investigates the gap between theories and practices in teaching's effectiveness.

Issues Related to AI Usage in Education

AI can enhance learning through personalized approaches, automated assessments, and improved access to information (Firdaus et al., 2024; Putri et al., 2023). It also raises concerns about privacy, security, and the potential for misinformation (Wiboolyasarin et al., 2024). The integration of AI in education can positively impact the relationship between educators and students, encompassing intellectual, emotional, and spiritual aspects. However, excessive reliance on AI may lead to personal disconnection and reduced motivation to learn independently (Wiboolyasarin et al., 2024; Firdaus et al., 2024). To address these challenges, previous researchers suggest implementing AI ethics education, stringent regulations, and balancing AI use with human interaction (Putri et al., 2023). As AI continues to evolve, understanding its role in education is crucial for improving learning outcomes and preparing students for a technology-driven future. Although research has investigated students' attitudes and the effects of chatbot usage on learning outcomes (Zhang et al., 2023), the concern regarding students becoming absent-mindedness due to reliance on AI is still not well studied. Therefore, this study attempts to investigate the impact of AI towards students' memory retention and retrieval.

METHODOLOGY

This study involved four phases, namely online survey distribution, semi-structured interview, observation of lecturer's teaching style and observation of students' learning style. First phase, online surveys were distributed among landscape architecture students from two different universities that have the same program. The universities chosen to participate in this study were Universiti Teknologi Malaysia (UTM) and Universiti Malaysia Kelantan (UMK). The respondents consist of lecturers and students from first-year until final-year. Next phase, semi-structured interviews were conducted to the lecturers and students using sets of questions aligned with the research questions. Subsequent phase, discrete observations were conducted on lecturers' teaching style and students' reactions. Final phase, discrete observations were conducted in class to see how the students behave towards the lecturers' teaching styles. This mixed-method approach was crucial for gaining a thorough understanding of how both AI-assisted and non-AI-assisted teaching and learning methods can affect students' memory retention and information retrieval.

Participants

The recruitment criteria of selecting participants are a) the students are enrolled in the landscape architecture program at any university; and b) the lecturers who are teaching the selected students will be automatically part of the participant too. Therefore, this study chose UTM and UMK as the university participants because they have landscape architecture program. Students of all semesters and their lecturers were engaged as respondents, consisting of 17 lecturers and 46 students. Among the 46 students, 17.4% is from first year, 15.2% from second year, 41.3% from third year and 26.1% from fourth year. These students are chosen because almost all of the them are aware and have been using AI throughout their studies. The demographic breakdown for lecturers revealed a majority of female participants (68.75%) and male participants (31.25%). The lecturer participants demonstrated a wide range of teaching experience, spanning from 1 to 32 years in the field. In terms of technology ownership, all participants owned various devices, such as tablets and smartphones, as well as other assorted gadgets.

Semi-structured interviews

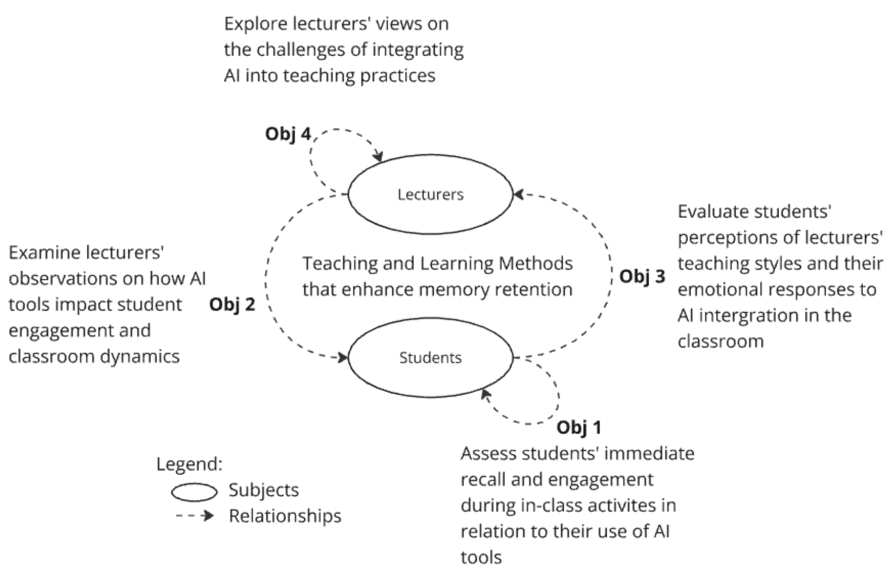
The study utilizes two forms of semi-structured interviews. The first form is the internal dialogue exchange interview, which entails qualitative interviews that involve interactions between a large group or focus group discussions virtually. The interviews were conducted through an online platform such as WhatsApp. This study also uses Mentimeter, Miro, and Google Forms, as the media to collect written responses.

Table 1
Few examples of questions for the semi-structured interviews

No	Example of Question
1	To what extent do you rely on AI for tasks like cost estimation, perspectives, design idea generation and etc?
2	Describe a specific experience, positive or negative, of using AI technologies in your landscape architecture studies.
3	What are your main concerns or reservations about the use of AI in landscape architecture studies?
4	How do you think landscape architecture curriculum and teaching approach should evolve to prepare students for the increasing role of AI in the profession?

The second form is the informal semi-structured interview style, which is the face-to-face approach. The interviewer and interviewee(s) will participate in a face-to-face conversational discussion known as a 'conversation with a purpose' (Ruslin et al., 2022). Table 1 shows the few examples of question asked during the interview session. The outcome of this method is an audio recording. All written and verbal responses were transcribed for the purpose of thematic analysis. Following the completion of the interviews and transcription process, significant themes, patterns, and insights will be generated.

There are four sets of semi-structured interviews to cover the research objectives. The questions were designed with the following objectives (Figure 5):



Source: Author's own work
Figure 5. The relationship between objectives with subjects to be tested

Objective 1: To assess students' immediate recall and engagement during in-class activities in relation to their use of AI tools (from Mentimeter)

Objective 2: To examine lecturers' observations on how AI tools impact student engagement and classroom dynamics (from interview with lecturers)

Objective 3: To evaluate students' perceptions of lecturers' teaching styles and their emotional responses to AI integration in the classroom (from students' evaluation forms)

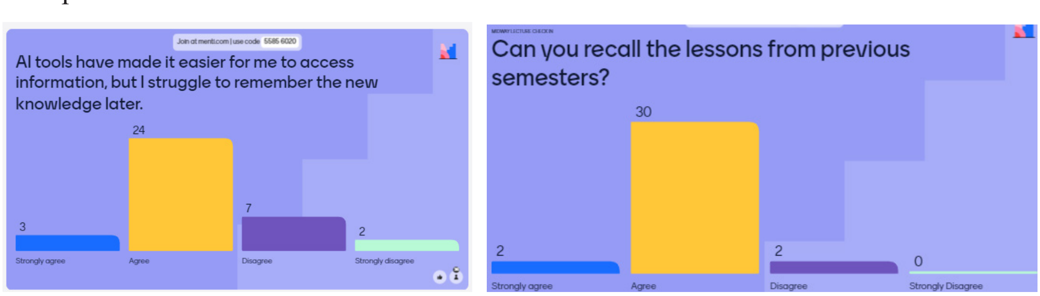
Objective 4: To explore lecturers' views on the challenges of integrating AI into teaching practices (output from focus group discussion (FGD) with lecturers)

Data analysis rationale

The rationale for using a mixed-method approach stems from the complementary strengths of both intangible factors and surprising elements arising from the themes. The quantitative analysis was performed through descriptive analysis of feedback collected via Google Forms, providing an overview of student engagement with AI. Meanwhile, the qualitative analysis, conducted through thematic analysis of semi-structured interviews, offered a deep understanding of personal experiences and perspectives that quantitative methods alone could not reveal. The thematic analysis, which was done manually, enabled the study to investigate the nuanced aspects of respondents' interactions with AI chatbots, uncovering detailed and context-specific factors that influence students' memory retention and retrieval in educational contexts. This method allowed for a comprehensive understanding of the macro-level perspective by identifying key factors and their interrelationships, while the qualitative data provided insights at the micro-level regarding individual experiences and contextual influences.

RESULTS

This study found that 75% (Figure 6, left) of the students agreed that AI can make them too dependent on the tool. But almost 94% (Figure 6, right) of students also said that they can recall the previous lessons. Whereas based on lecturers' in-class observation, students were unable to recall previous lessons. It is because students only think they can recall but actually the level of recalled information was not up to what the lecturers have taught or expected.



Source: Author's own work

Figure 6. Students' responses of how they struggle to remember new knowledge (Left) and students' responses of how they able to recall previous lessons (Right)

There are two main reasons for this phenomenon. The first reason is that lecturers believed that they had delivered the lessons successfully to students. However, the lessons did not reach students' long-term memories. This may be due to the teaching style, which lacked active learning activities in class. Engaging activities can stimulate students' short-term memory (STM) and working memory (WM). However, as part of their survival mechanism, students often study only to pass exams, which means they store information in the STM, just like storing phone numbers before dialing them. After the examination, the information decays just like the phone number scenario.

The second reason is that students believe they have already achieved the standard of knowledge. However, they have retained was only 50% of the entire lesson. To overcome this, students use AI to help them recall what they missed. This behavior hinders the practice of long-term memory (LTM) storage. Students become too dependent on AI, which discourages the use of STM and WM practices. As a result, the cycle of forgetting continues, bringing them back to square one.

FINDINGS

Findings for Objective 1: To Assess Students' Immediate Recall and Engagement During in-Class Activities in Relation to Their Use of AI Tools (from Mentimeter)

Table 2 shows students' written responses from the semi-structured interviews. The questions were aimed at how the students evaluate their own memory retention and retrieval based on their in-class learning style related to AI usage. It was found that lack of critical thinking was the main problem. Based on the thematic analysis, there are five major themes were identified, namely a) need hands on; b) no critical thinking; c) overwhelmed; d) absent active learning; and e) Inability to integrate previous lessons. All the theme leads to one major conclusion which is AI makes students inattentive. 'Need hands on' (37%) means performing the related activities can dramatically increase retention rates. A research indicated that students retain only about 5% of material presented through traditional lectures, while retention can soar to approximately 75% when students actively participate in hands-on activities (Senior, 2011). This experiential learning allows students to engage with the material in a meaningful way, making it easier to recall information later.

'Overwhelmed' (23%) means students received too much information and experienced cognitive overload. Students were too dependent on AI for every answer especially when doing revision, without referring to handwritten notes anymore. Written notes often capture lecturers' invaluable experience which cannot be generated through AI. Hence, there is a need to balance the AI usage with lecturer's input. There is also a need to expose the students on how to use AI ethically, intelligently and with less dependency.

'Absent active learning' (20%) means students may resist participation because they perceive active learning tasks as more challenging or time-consuming. Students resist because they find the activities uninteresting or irrelevant to their lives. They also resist because they have not completed readings on the topic of the activity, which were assigned before coming to class, leaving them feeling unprepared to engage with the activities.

'No critical thinking' (17%) means students are unskillful on how to ask the right questions, evaluate resources, or apply critical perspectives to their assignments. This lack of analytical skills can lead to superficial engagement with the material, where students memorize information without analyzing or synthesizing it effectively. Eventually students lack critical thinking skills and experience cognitive overload leading to confusion and disengagement.

'Inability to integrate previous lesson' (3%) means students cannot manage to recall the previous semester's lessons and bring the information into the current semester. This indicates that students have poor LTM retrieval. The results suggest that there might be no active learning conducted in class to practice the LTM retrieval, hence the students equate this phenomenon as forgetful.

Table 2
Students written responses of how AI affected their memory retention

Major Theme	Responses from interview sessions	Relationship with STM, WM, LTM	Signs of Cognitive Overload	Findings
Need hands on	1. ...not scribbling any notes and only reading instead of actively thinking 2. Didn't use it in daily life always 3. Because not use in daily basis 4. ... often c/p the work without actually read the explanation 5. If I didn't apply it in my work then I may forget those thing I've learnt 6. ... insufficient long-term memory consolidation. 7. ...material isn't reviewed being frequently, 8. Lack of practice in the lessons. 9. ...I have to do hands on work instead of relying solely on slides and lectures 10. Doesn't have enough time to do revision... 11. ...less time to do revisions	Incomplete STM practice	Did not prepare themselves the technique to learn itself. Need to learn 'how to learn'. Needs hands on activities such as taking notes and jotting them down. The act of writing can engrave the information in your brain.	

Major Theme	Responses from interview sessions	Relationship with STM, WM, LTM	Signs of Cognitive Overload	Findings
No critical thinking	1. Too depending on AI for every answers 2. ...do revision using AI 3. Too much knowledge/ information to handle 4. ... recall the lessons use artificial intelligence 5. ...revision using AI	Passed STM but lack of WM and LTM	Students are creative to explore trending learning methods such as chatbots AI, design AI, and writing AI. But sometimes students tend to misuse the technology.	
Overwhelmed	1. Sometimes a lot to cover so cannot recall. 2. ...a lot of inputs that need to be remembered. 3. ...too many things to remember 4. ...because a lot of information and knowledge to remember 5. ...many course that i need to do and think 6. Too many projects 7. I tend to forget because there is a lot of input to learn and so many interesting facts and knowledge we get.	Lack of LTM practice	Did remember the lessons only during the current semester, but the following semester they often forget. Signs of information stored in LTMs were not achieved.	This is where the problem is rooted. Students do not know how to use AI effectively. Resulting in being overwhelmed by too much information. Therefore, this is where the teaching and learning intervention needs to take place. Teach students how to use AI ethically, intelligently, less dependent, and superior over that advanced technology.
Absent Active Learning	1. Incomplete self notes make me harder to review 2. Not focus 3. I might forget things such as scientific names... 4. I can remember what I learn but it is maybe just tiny details... 5. Not good memory 6. Because lot of chapter to remember and my memory not going well	The first step before enhancing STM, WM and LTM.	Students unable to memorize and retain the information	
Inability to integrate previous lessons	1. ...lesson from previous is different by topic	The final step after STM, WM and LTM.	Students unable to retrieve information from LTM	

Source: Author's own work

In summary, different learning styles influence memory retention, particularly in environments where AI tools are utilized. Students were found to be unable to recall lessons taught in previous semesters and apply them in the current semester. A research indicated that students often struggle to retain knowledge from previous semesters, despite performing well during classes (Ladage et al., 2018). Based on the survey with students, 79% agreed that AI tools have made it easier for them to access information, but they struggled to remember the new knowledge later. The reasons were that they often use generative AI to generate knowledge. They acknowledged that they are too reliant on AI for every question. The information was generated immediately and overwhelmingly, which led to unwillingness in memorization. One of them mentioned that, in order to remember the lesson, they scribble and doodle. Such actions help them remember longer. Too much information makes memorization and recalling harder. Scientific terms and jargons can make the memorization process even more challenging. They did admit that they often copy and pasted AI answers without actually reading the explanation itself. They also did not get the chance to apply their newly learned knowledge in class, hence forgetting them. According to Ebbinghaus (1913), people forget around 56% of new information within an hour, 66% after a day, and 75% after six days if they do not review or practice. This finding aligns with Ebbinghaus's theory, as students begin losing information immediately after a lecture ends, with the rate of forgetting accelerating over time. Therefore, spaced repetition is important to ensure memory retention, be it with or without the aid of AI.

Findings for Objective 2: To Examine Lecturers' Observations on How AI Tools Impact Student Engagement and Classroom Dynamics (from interview with lecturers)

Table 3 shows the thematic analysis of problems faced by lecturers to ensure students are active in class. This method gathers data through semi-structured interviews with lecturers. Lecturers were asked what they observed when they implemented active learning in class using AI tools. Most of the lecturers found that students are hesitant to participate in-class activities. However, more issues also arise in the responses which have been thematically analyzed. There are five major themes found, namely a) preconceived knowledge; b) time; c) facility; d) attention; and e) teaching style.

Based on Table 3, lecturers were asked a question of what are the common problems they have faced when trying to engage students to be actively involved in the learning process in the classrooms. 74% of the lecturers said that the main problem was the "preconceived knowledge" related factor. Students were observed to be shy, lacking in participation, reluctant to get involved in class activities, possibly because they were afraid to look unintelligent in front of their peer if they answered questions incorrectly. This phenomenon was rooted from the lack of preconceived knowledge pertaining to the topic discussed that day. About 13% of the lecturers agreed that "time" related factors such as prolonged time was wasted on handling new AI tools, inefficient class timing due to conducting ineffective active learning activities, and eventually takes a lot of time without any productive outcomes. This is mostly because, not everyone is trained to use the AI interface. Some may be using the AI for the first time and are unfamiliar with how to use it, which can prolong the time spent on the task. Once AI is mastered, students still need to comprehend what the questions meant, which also requires additional time. The responses suggest that about 5% of the lecturers raised the issue of "facility" related factors which also contributed to the uncooperative behavior of students to participate in active learning activities. Some examples of the facility-related factors include poor internet connection, a classroom setting is not conducive to supporting an active learning style, and the microclimate and ambient conditions in the class, which also play a crucial role in helping students stay attentive throughout lessons. About 4% of lecturers agreed that the "attention" related factor was one of the subtle reasons why students hesitate to participate in class activities. It is because when students are allowed to use their own smart devices, they tend to derail from the actual activities. Many pop-ups and notifications flashing in front of their eyes prompting them to immediately attend to the notification. But the fact that they will spend at least 10 minutes or more being derailed from the actual task can be time consuming and cause delay to task completion. This domino effect will lead to extended class hours. Finally, only 4% of lecturers said that "teaching style" related factors can contribute to the inactive class engagement.

In summary, this phenomenon was rooted from the lack of preconceived knowledge pertaining to the topic discussed that day causing inactive participation in the activities. Inefficient class timing (time factor) due to conducting ineffective active learning activities, eventually takes a lot of time without any productive outcomes. A class that drags on too long make students inefficient in completing their other assignments. One issue is that students cannot commit to submission due dates. When given a deadline, 50% of them did not meet the cut-off date. Moreover, facilities that support learning also play a crucial role in helping students to stay attentive throughout the lessons. Unconducive environment makes the class to be too focused on the facility problem rather than the lesson itself. Attention deficit also makes a lesson inefficient and lesson delivery delayed such as derailing from actual tasks can be time consuming and cause delays to task completion. Finally, a teaching style which is outdated tend to bore the students which leads to mindless and day-dreaming appearances in class.

Table 3

Thematic analysis of problems faced by lecturers to ensure students are active in class

Major Theme	**Response**	**Potential Cause**	**Relationship with STM, WM and LTM**
Preconceived Knowledge	1. Students are shy (x4) 2. Lack of participation / involvement / engagement / interest / ideas / confidence (x16) 3. Passive students (x4) 4. Blur students (x3) 5. Some students did not want to even try the activity. 6. Students are reluctant to express opinions 7. The activity does not help students achieve understanding in the class 8. Student who are not prepared for the topic or discussion 9. Comfortable with spoon-fed learning 10. Slow response 11. Afraid their answers will be judged by other friends 12. Students are not exposed to active learning 13. "Takes two to tango" – only the lecturer is excited but the students are not. 14. Students are afraid to give or share their opinion 15. Afraid of being judged 16. Activity is not suitable or boring.	This phenomenon was rooted from the lack of preconceived knowledge pertaining to the topic discussed that day causing inactive participation in the activities.	
Time	1. Time constraints (3x) 2. Take more time 3. Takes too long, derails train of thought 4. Designing prompting questions or discussion that are time-bound 5. Time constraint to prepare teaching material	Inefficient class timing due to conducting ineffective active learning activities, eventually takes a lot of time without any productive outcomes.	
Facility	1. Class setting 2. Student seating (classroom / lecture style) is not optimal 3. Network failure	Facilities that support learning also play a crucial role in helping students stay attentive throughout the lessons.	Some STM is happening but students have issues with themselves such as social phobia (fear of peer comparison)
Attention	1. Attention deficit 2. Distracted to other apps while using technology-based activities	Derailing from actual tasks can be time consuming and cause delays to task completion.	
Teaching Style	1. Lecturers were exhausted to keep trying to engage student to be active in class 2. Lecturers were not creative in facilitating students to understand the lessons	Burnout lecturers have exhausted all available teaching styles resulting in them conducting the class merely as a duty, without prioritizing the learning experience of their students.	

Source: Author's own work

Findings for Objective 3: To Evaluate Students' Perceptions of Lecturers' Teaching Styles and Their Emotional Responses to AI Integration in the Classroom (from Students' Evaluation Forms)

Table 4
Students comments towards lecturers' teaching style

Major Theme	Students responses that have issues	Positive emotions presence can determine smooth memory retention and vice versa	Relationship with STM, WM, LTM
Responsibility	Always busy ... Lectures are not easily accessed ... Too many lectures in one shot.	Negative emotions	Discourage all possibilities of memory retention
Conventional Teaching Strategies	Lack of variety in teaching methods Need more outdoor activities Need more interaction between lecturer and students Need more pictures and videos during lectures Need to learn actual problem solving on site Need more examples in class Students often get confused		
Superficial instructions	Instruction not clear Required extra external input Need more time to complete tasks		
Lack of active learning activities	Students fell asleep in class Need more physical examples from lecturer Information delivered by the lecturer is unclear Students felt confused		
Students' survival mode	Students requesting to do computerized assignments. Asking for any assignment or answer templates they can follow		

Source: Author's own work

Table 4 displays students' comments towards lecturers' teaching style collected from a semester of student's evaluation form of each lecturer. The content of the written responses was transcribed and thematically analyzed aiming to evaluate students' perceptions of lecturers' teaching styles and how AI usage affect their memory retention.

It was found that most students experience mixed emotions in most classes. Based on the thematic analysis, five major themes were identified, namely a) Responsibility; b) Conventional Teaching Strategies; c) Superficial Instructions; d) Lack of Active Learning Style; and e) Students' Survival Mode. Responsibility refers to the lecturers' commitment in conducting the class as instructed by the department. However, the students found that 16% of the lecturers did not conduct the class properly.

Conventional Teaching Strategies refers to lecturers using the traditional "stand-and-deliver" lecture as their primary teaching method. It was observed 37% of the students mentioned that conventional methods are still being practiced. Research indicates that students in lecture-based classes are significantly more likely to fail compared to those in active learning environments, highlighting the ineffectiveness of this method in promoting understanding and retention.

Furthermore, Superficial Instructions refers to the unclear instruction given to the students. 16% of the students agreed that superficial instruction made them lost in conducting class activities and assignments. Lack of Active Learning in the class refers to lecturers who fail to incorporate interactive elements like quizzes, discussions, or problem-solving activities into their lectures to promote active learning. 20% of the students said that the lecturers are comfortable giving lecture for an entire class period without opportunities for students to apply what they are learning. Such teaching styles could stir mixed emotions among students during the class.

These mixed emotions can push students into Survival Mode, where they prioritize mere compliance over genuine learning. For instance, 11% of students frequently resort to negotiating alternative submission methods with lecturers or requesting assignment templates, aiming to meet expectations directly without deeper critical thinking.

Findings for Objective 4: To Explore Lecturers' Views on the Challenges of Integrating AI into Teaching Practices (Output from FGD with Lecturers)

Table 5 is showing the lecturers' responses towards why they teach the way they did. Based on Table 5, two major themes were identified as a) conventional teaching strategies; and b) industry-driven. Several themes have been defined in the previous sections, only industry-driven is needed to be explained further. Industry-driven teaching style (20%) meaning the teaching styles that aligns academic content with real-world scenarios, ensuring that students acquire skills and knowledge that can be directly applied to their future careers. This experiential learning method improves critical thinking and the practical application of knowledge, enabling students to gain a more profound understanding of the subject.

Based on the feedback, rarely the respondents mentioned on AI integration in class. This is in line with the observation in-class, most lecturers are senior (more than 10 years of teaching) and they did not have any recent training on how to employ AI in the class. Consequently, many of these experienced lecturers continue to employ lecturer-centered pedagogies. In contrast, newer lecturers, with fewer than ten years of teaching experience, are still in the process of developing their teaching methodologies. Many of these individuals are receptive to adopting contemporary and innovative teaching approaches, including student-centered learning and the integration of artificial intelligence (AI) in their classrooms.

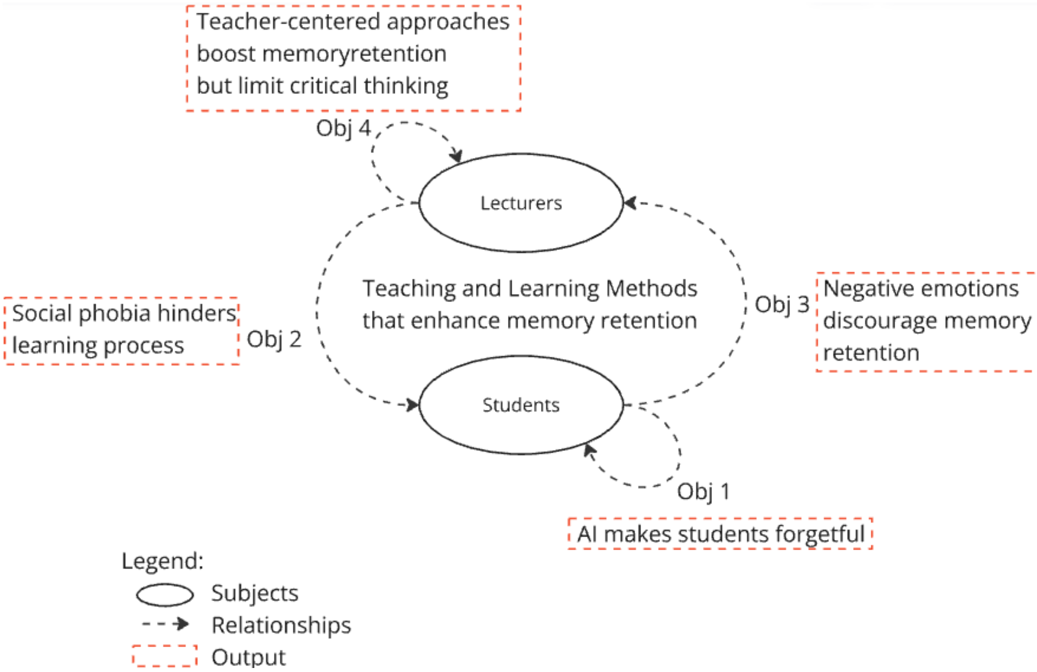
Table 5

Lecturer comments towards their teaching style

Major Theme	**Lecturers' responses of why they teach the way they did**	**Teaching approach**	**Relationship with STM, WM, LTM**
Conventional Teaching Style	1. Founder of the program teach like this since the beginning of the program	Teacher-centered	
	2. We have been practicing teaching like this as what senior lecturers had passed down to us.	Teacher-centered	
	3. We have revised some of the teaching style so far this is the best we have	Teacher-centered	
	4. Teach as long as the syllabus is delivered	Teacher-centered	
	5. No familiar with current teaching method		
	6. Teach according to given schedule	Teacher-centered	
	7. Lack of reference to refer what is the best teaching method	Teacher-centered	
	8. Teach using whatever technique as long as the students understood	Teacher-centered	
	9. Also have other tasks that are also demanding too complicated.	Teacher-centered	
	10. Too busy with other positions in other units. Therefore, no time to update the teaching style	Teacher-centered	
	11. Have other units attend to.		
	12. Just teach as usual to avoid bad comments from department	Mix of few teaching approaches	
	13. Would like to change some of the conventional teaching style, but was criticized by senior lecturers	Mix of few teaching approaches	
	14. Despite wanting to try a new or trending teaching style, senior lecturers criticized it because the style might not deliver the course content as expected.		
	15. Cute challenging to be the one who is going the other direction. Meaning that, even challenge while trying to implement a new teaching style unless the others are still practicing conventional role.		Some STM can be practiced in class. But due to unengaging class experience, students will not achieve LTM.
	16. Just go with the flow because I am already retired		
Industry-Driven Teaching Style	Teaching as if what the industry wants of a student.	Project-based	
	Sometimes no technical. Students have not work yet, therefore they could not comprehend the actual application	Project-based	
	Teaching goes hand in hand with what the local authority want.	Project-based	
	Teaching until the students understand	Project-based	

Source: Author's own work

DISCUSSIONS



Source: Author's own work

Figure 7. The major findings related to objectives.

Discussion of Objective 1: AI Makes Students Inattentive

Students nowadays preferred computerized works over manual drafting. Using a computer will lessen their hand-eye coordination and fine motor skills during studying. According to a study, the usage of AI has a negative impact on a student's creativity, (Rajan and Niranjan, 2025). Lack of these steps will hinder the process of storing information in short-term memory and working memory (Figure 7, Objective 1). Indirectly, can cause students to forget information as in the Ebbinghaus Effect (1985).

This study observed students forgetting tasks due to reliance on AI and not effectively using abundant information can be related to the "doorway" effect in a metaphorical way. Just as walking through a doorway causes the brain to reset its mental context (Jafarpour, Buffalo, Knight, and Collins, 2022). Overwhelming exposure to vast amounts of AI-generated information can cause cognitive overload, leading to a type of mental "reset" or disruption in task retention.

When students depend heavily on AI to provide information, they may experience difficulty in organizing and integrating that information into their working memory (WM) or long-term plans. This influx of abundant data can act like crossing multiple "mental doorways," frequently shifting their focus and causing fragmentation of their thoughts and intentions. As with the “doorway” effect, these context shifts—moving from one AI-supplied topic or task to another—can make it harder for students to retain specific tasks or goals, leading to forgetfulness or reduced task follow-through.

In essence, just as physical boundaries can disrupt memory by creating mental context shifts, the cognitive challenge of managing abundant AI information without clear integration strategies can similarly disrupt students’ ability to keep track of and complete tasks effectively. This highlights the importance of mindfulness, organization tools, and task management strategies when using AI to avoid the “doorway” effect of cognitive overload.

Discussion for Objective 2: Social Phobia

The students studied were from the Gen Y, Gen Z and Gen Alpha generations. They are the ones who started to use smart devices such as smartphones, computers, and tablets from early childhood. Such devices are handy for them to obtain knowledge. However, vast knowledge comes with new phobias. While acquiring vast knowledge can empower individuals and enhance their understanding of the world, it can also introduce new fears and anxieties, such as social phobia. In this study, students are observed to have social phobia and fear of peer comparisons (Figure 7, Objective 2). They were seen to have developed phobias related to social acceptance, performance, or judgment, fearing that they do not measure up to their peers’ achievements or knowledge. The non-verbal cues from peers, such as scowls or disapproving looks, can discourage participation. Students often fear being judged by their peers or lecturers, which can inhibit their willingness to participate in class activities. This can lead to anxiety disorders, such as social phobia or performance anxiety. Thus, they did not want to respond to lecturers’ questions in class as the manifestation of social phobia.

Discussion for Objective 3: Negative Emotions Discourage Memory Retention

The relationship between positive emotions and memory retention is a significant area of study, particularly in light of Ebbinghaus’s Forgetting Curve, which illustrates how information is forgotten over time. Research indicates that positive emotions can significantly enhance memory recall. When individuals experience positive emotions, their brain engages more actively in the encoding and retrieval processes (Figure 7, Objective 3). This is because emotional experiences activate areas of the brain, such as the amygdala and hippocampus, which are critical for memory formation and retrieval. As a result, information learned in a positive emotional context is often remembered more vividly and for longer periods.

Discussion Objective 4: Teacher-Centered Boost Memorization but Limit Critical Thinking

A teacher-centered approach primarily involves direct instruction where the teacher controls the learning environment, often leading to passive learning among students (Figure 7, Objective 4). This method can enhance memory retention for foundational knowledge but may hinder critical thinking and problem-solving skills due to limited student engagement and autonomy. It is because teacher-centered classrooms tend to give students less control over their learning. Studies indicate that while it can be effective for memorization, it does not promote deep understanding or long-term retention as effectively as student-centered methods, which encourage active participation and meaningful learning experiences.

Practical Implication

To mitigate the negative impacts of excessive AI reliance on memory retention, educators must implement structured AI scaffolding paired with active learning strategies. Rather than allowing passive dependency, lecturers should explicitly teach students how to utilize AI intelligently and ethically, guiding them to critically evaluate generated information. Because traditional teacher-centered lectures yield only about 5% memory retention compared to 75% through active participation, AI usage must be intentionally integrated with hands-on, experiential activities to properly stimulate short-term and working memory. Furthermore, to prevent the cognitive overload and mental "doorway effect" caused by an overwhelming influx of AI data, educators should introduce structured task management strategies and organizational tools. Ultimately, transitioning to a student-centered approach that fosters a positive emotional environment can counteract stress and significantly enhance robust long-term memory formation.

CONCLUSION

Over-relying on AI severely harms landscape architecture students' memory retention. The field demands a complex blend of spatial reasoning, ecological knowledge, and artistic skill. Traditionally, students build spatial and kinesthetic memory through manual drafting and physical modeling. Using AI image generators bypasses this crucial tactile engagement. Consequently, students fail to internalize scale, topography, and human movement, leaving them unable to spontaneously sketch or adapt designs on-site.

AI usage also encourages the cognitive offloading of botanical and material knowledge. Landscape architects rely on a vast mental database of plants and hardscape materials. When students use chatbots to instantly generate planting palettes, they treat the AI as an external hard drive. Skipping the active search and evaluation process keeps this information trapped in short-term working memory. It never reaches long-term storage, leaving students unable to recall essential ecological data during client meetings.

Furthermore, AI shortcuts lead to superficial site analysis and an "illusion of competence." Proper design requires the deep processing of overlapping systems, such as hydrology and zoning laws. When AI instantly summarizes site constraints, students experience shallow encoding. They recognize the issues and falsely believe they fully comprehend the site. Without the productive struggle of manually mapping these systems, they fail to form the dense neural connections needed for real environmental problem-solving.

Finally, bypassing these foundational steps strips students of their core design logic. The iterative struggle of solving spatial puzzles—like grading a steep slope—cements the "how" and "why" of a design into memory. When AI automates layouts, it provides final answers without teaching the underlying methodology. Students may remember the final image, but they cannot retrieve the logic needed to defend or adapt it. To build robust professional memory, students must engage in the cognitive struggle of the craft, using AI strictly for inspiration rather than a replacement for learning. The interplay of artificial intelligence (AI) in education, student social dynamics, and traditional teaching methods can significantly impact memory retention and learning outcomes. Therefore, AI tools may inadvertently contribute to the inattentiveness behavior among students by providing them easy access to information, reducing the need for active recall and deep processing.

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REFERENCES

Alemdag, E. (2023). *The effect of chatbots on learning: A meta-analysis of empirical research*. *Journal of Research on Technology in Education*. Advance online publication. https://doi.org/10.1080/15391523.2023.2255698

Annamalai, N., Rashid, R. A., Munir Hashmi, U., Mohamed, M., Harb Alqaryouti, M., & Eddin Sadeq, A. (2023). *Using chatbots for English language learning in higher education*. *Computers & Education: Artificial Intelligence, 5*, Article 100153. https://doi.org/10.1016/j.caeai.2023.100153

Bearman, M. (2019). Focus on methodology: Eliciting rich data: A practical approach to writing semi-structured interview schedules. *Focus on Health Professional Education: A Multi-Professional Journal, 20*(3). https://doi.org/10.11157/fohpe.v20i3.387

Deng, X., & Yu, Z. (2023). A meta-analysis and systematic review of the effect of chatbot technology use in sustainable education. *Sustainability, 15*(4), Article 2940. https://doi.org/10.3390/su15042940

Ebbinghaus, H. (1913). Memory: A contribution to experimental psychology (H. A. Ruger & C. E. Bussenius, Trans.). Teachers College, Columbia University. (Original work published 1885).

Firdaus, M. R., Irawan, R. R., Huda, C., Mahardika, Y., Lumban Gaol, P., & Prinaryanto, B. A. (2024). Tantangan teknologi artificial intelligence pada kegiatan pembelajaran mahasiswa. *Indonesian Journal of Education and Development Research, 2*(1), 379–384. https://doi.org/10.57235/ijedr.v2i1.1781

Fokina, M. (2024). *The future of chatbots: 80+ statistics, industry trends & benchmarks*. Tidio. https://www.tidio.com/blog/chatbot-statistics/

Fortino, A., & Lowrance, R. (2019). Practice makes perfect: Memory retrieval strategies to improve student academic performance. In *Proceedings of the 79th Annual Meeting of the Academy of Management: Understanding the Inclusive Organization*. https://doi.org/10.5465/AMBPP.2019.44

He, Y., & Bu, Y. (2026). Academic journals' AI policies fail to curb the surge in AI-assisted academic writing. *Proceedings of the National Academy of Sciences of the United States of America*. https://doi.org/10.1073/pnas.2526734123

Irman. (2019). The effectiveness of mind mapping techniques in counseling of enhancement ability memory students in learning. *Ta'dib, 22*(2). https://doi.org/10.31958/jt.v22i2.1424

Jafarpour, A., Buffalo, E. A., Knight, R. T., & Collins, A. G. E. (2022). Event segmentation reveals working memory forgetting rate. *iScience, 25*(2), Article 103902. https://doi.org/10.1016/j.isci.2022.103902

Kuhail, M. A., Alturki, N., Alramlawi, S., et al. (2023). Interacting with educational chatbots: A systematic review. *Education and Information Technologies, 28*, 973–1018. https://doi.org/10.1007/s10639-022-11177-3

Ladage, L. D., Tornello, S. L., Vallejera, J. M., Baker, E. E., Yan, Y., & Chowdhury, A. (2018). Variation in behavioral engagement during an active learning activity leads to differential knowledge gains in college students. *Advances in Physiology Education, 42*(1), 99–103. https://doi.org/10.1152/advan.00150.2017

LaRocque, J. J., Lewis-Peacock, J. A., & Postle, B. R. (2014). Multiple neural states of representation in short-term memory? It's a matter of attention. *Frontiers in Human Neuroscience, 8*, Article 5. https://doi.org/10.3389/fnhum.2014.00005

Liu, C. C., Liao, M. G., Chang, C. H., & Lin, H. M. (2022). An analysis of children's interaction with an AI chatbot and its impact on their interest in reading. *Computers & Education, 189*, Article 104576. https://doi.org/10.1016/j.compedu.2022.104576

Masukume, G. (2024). The impact of AI on scientific literature: A surge in AI-associated words in academic and biomedical writing. *medRxiv*. https://doi.org/10.1101/2024.05.31.24308296

Nie, J., Zhang, Z., Wang, B., Li, H., Xu, J., Wu, S., Zhu, C., Yang, X., Liu, B., Wu, Y., Tan, S., Wen, Z., Zheng, J., Shu, S., & Ma, L. (2019). Different memory patterns of digits: A functional MRI study. *Journal of Biomedical Science, 26*(1), Article 1. https://doi.org/10.1186/s12929-019-0516-y

Norris, D. (2017). Short-term memory and long-term memory are still different. *Psychological Bulletin, 143*(9), 992–1009. https://doi.org/10.1037/bul0000108

OpenAI. Chatgpt. (2022) https://chat.openai.com/

Putri, V. A., Sotyawardani, K. C. A., & Rafael, R. A. (2023). Peran artificial intelligence dalam proses pembelajaran mahasiswa di Universitas Negeri Surabaya. *Prosiding Seminar Nasional*, 615–630.

Rajan, S., & Niranjan, L. R. (2025). The double-edged sword of ChatGPT: Fostering and hindering creativity in postgraduate academics in Bengaluru. *International Journal of Educational Management, 39*(2), 317–337. https://doi.org/10.1108/IJEM-03-2024-0181

Ray, S., & Ray, D. P. (2024). Artificial intelligence in education: Navigating the nexus of innovation and ethics for future learning landscapes. *International Journal of Research - GRANTHAALAYAH, 11*(12). https://doi.org/10.29121/granthaalayah.v11.i12.2023.5464

Rong, W., & Yu, Z. (2023). Do AI chatbots improve students' learning outcomes? Evidence from a meta-analysis. *British Journal of Educational Technology, 55*(1), 10–33. https://doi.org/10.1111/bjet.13334

Ruslin, Mashuri, Abdul Rasal, M. S., Alhabsyi, F., & Syam, H. (2022). Semi-structured interview: A methodological reflection on the development of a qualitative research instrument in educational studies. *IOSR Journal of Research & Method in Education, 12*(1), 22–29. https://doi.org/10.9790/7388-1201052229

Saylam, S., Duman, N., Yildirim, Y., & Satsevich, K. (2023). Empowering education with AI: Addressing ethical concerns. *London Journal of Social Sciences, 6*, 39–48. https://doi.org/10.31039/ljss.2023.6.103

Senior, B. A. (2011). Enhancing the construction parade of trades game. In *Proceedings of the 47th ASC Annual International Conference*.

Simbolon, M. E., Borolla, F. V., Prasrihamni, M., & Supena, A. (2022). Mnemonic techniques in slow learner student learning in elementary school. *Jurnal Kependidikan: Jurnal Hasil Penelitian Dan Kajian Kepustakaan Di Bidang Pendidikan, Pengajaran Dan Pembelajaran, 8*(2), 470. https://doi.org/10.33394/jk.v8i2.5143

Tasnimi, M. (2017). Short-term memory vs. working memory. *International Journal of English, Literature and Social Science, 2*(1), 38–40. https://www.ijels.com/

Westman, A. S., & Lewandowski, L. M. (1991). Presentation does not guarantee recall: Students need to learn study habits. *Perceptual and Motor Skills, 72*(3_suppl), 1316–1318. https://doi.org/10.2466/pms.1991.72.3c.1316

Wiboolyasarin, W., Wiboolyasarin, K., Tiranant, P., Boonyakitanont, P., & Jinowat, N. (2024). Designing chatbots in language classrooms: An empirical investigation from user learning experience. *Smart Learning Environments, 11*(1), Article 19. https://doi.org/10.1186/s40561-024-00319-4

Yuan, Y. (2023). An empirical study of the efficacy of AI chatbots for English as a foreign language learning in primary education. *Interactive Learning Environments*, 1–16. https://doi.org/10.1080/10494820.2023.2282112

Zhang, R., Zou, D., & Cheng, G. (2023). A review of chatbot-assisted learning: Pedagogical approaches, implementations, factors leading to effectiveness, theories, and future directions. *Interactive Learning Environments*, 1–29. https://doi.org/10.1080/10494820.2023.2202704