International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 13 Issue: 10 | Oct 2026 www.irjet.net p-ISSN: 2395-0072

Impact of Generative AI Dependence on Memory Retention & Learning Among Students in Navi Mumbai

Dr. Siji Nambiar[1], Akshata Bhatkar[2], Amisha Rajput[3]

[1]Assistant Professor, Department of MCA, D. Y. Patil Deemed to be University, School of Humanities & Sciences, Belapur, Maharashtra, India.

[23]Student, Department of MCA, D. Y. Patil Deemed to be University, School of Humanities & Sciences, Belapur, Maharashtra, India.

Abstract - *Generative Artificial Intelligence (GenAI) has become an important part of modern education, providing students with tools to generate answers, prepare summaries, solve problems, write assignments, and understand complex topics. Although these tools make learning faster and easier, excessive dependence on them may affect students' memory retention, independent thinking, and long-term learning abilities. This research focuses on understanding the impact of Generative AI dependence on memory retention and learning among university students in Navi Mumbai. It distinguishes between the use of AI as a learning assistant and dependence on AI, where students regularly rely on AI-generated answers instead of making their own efforts to understand and remember information. The study examines how cognitive offloading, or the process of transferring mental tasks to external tools, may influence students' ability to retain information over time. It also explores how different AI usage patterns, such as reflective, cautious, thoughtless, and collaborative use, may lead to different learning outcomes. Particular attention is given to the difference between students' perceived learning and their actual memory retention, as students may feel confident about a topic without being able to recall or apply the information independently. The study further considers the role of metacognitive self-regulation, which involves planning, monitoring, and evaluating one's own learning process. The research highlights the importance of using Generative AI responsibly and maintaining active student participation in learning activities. It aims to contribute to a better understanding of how AI can be integrated into education while supporting students' memory, independent learning, and long-term academic development.*

Key Words: Generative Artificial Intelligence, AI Dependence, Memory Retention, Cognitive Offloading, Student Learning, Higher Education, Metacognition, Learning Outcomes, Self-Regulated Learning, Academic Performance.

1. INTRODUCTION

The rapid development of Generative Artificial Intelligence (GenAI) has brought significant changes to the education system, particularly in the way students learn, study, and complete academic tasks. AI tools such as ChatGPT and other conversational AI systems can generate answers, explain difficult concepts, prepare summaries, solve mathematical problems, and assist students in writing assignments. These tools have made educational information easily accessible and have reduced the time and effort required to complete many academic activities. As a result, students increasingly depend on Generative AI for their daily academic work.

While the use of AI provides several advantages, it also raises important questions about its influence on students' memory retention, learning abilities, and independent thinking. The main concern is not simply whether students use AI, but whether excessive dependence on these tools reduces their active involvement in the learning process. Memory retention is an essential part of education because it allows students to remember, understand, and apply information even after a period of time. Effective learning requires students to actively process information, connect new concepts with existing knowledge, practise recalling information, and solve problems independently.

However, when students depend heavily on AI-generated answers, they may skip important mental activities such as reading, reasoning, analysing, and recalling information. This behaviour is related to a concept known as cognitive offloading, which refers to the use of external tools to reduce the mental effort required to complete a task. Although cognitive offloading can make tasks easier, excessive reliance on it may reduce the amount of information students actively process and remember. Therefore, students who regularly depend on AI to complete their academic work may experience a difference between completing a task successfully and actually learning or remembering the concepts involved.

Another important concern is the difference between perceived learning and actual learning. Students may feel that they understand a topic because AI provides clear explanations, well-organised answers, and immediate solutions. However, this feeling of understanding may not always indicate that they can independently recall or apply the information later. When students receive ready-made answers without making sufficient mental effort, they may develop an illusion of understanding. This can affect their ability to evaluate their own learning progress and identify areas that require further study.

At the same time, Generative AI is not necessarily harmful to learning. When students use it to clarify concepts, receive feedback, compare ideas, and improve their own answers, it may support deeper understanding and active learning. The impact of Generative AI on learning may therefore depend on how students interact with these tools rather than simply how frequently they use them. Reflective and collaborative use of AI may encourage students to think critically, evaluate information, and participate actively in learning, whereas thoughtless dependence may reduce independent cognitive effort.

Students' ability to plan their studies, monitor their understanding, and evaluate their learning strategies may also influence the outcomes of AI-assisted learning. In this context, the present research, titled Impact of Generative AI Dependence on Memory Retention and Learning Among Students, focuses on understanding the relationship between AI dependence and students' ability to retain information over time.

2. LITERATURE REVIEW

The increasing use of Generative Artificial Intelligence (AI) in education has attracted substantial research attention, particularly because AI tools can provide explanations, summaries, solutions, and other forms of academic assistance. While these technologies can improve learning efficiency and reduce students' workload, researchers have also raised concerns regarding excessive dependence on external digital resources, reduced cognitive effort, and its possible impact on long-term memory retention. Existing literature on cognitive offloading, effortful processing, metacognition, and self-regulated learning provides an important foundation for understanding how Generative AI may influence students' learning processes.

Cognitive offloading refers to the use of external tools, resources, or technologies to reduce the mental effort required to perform a task. In educational settings, students commonly use notes, search engines, calculators, and digital applications to support learning. Risko and Gilbert (2016) [8] explained that individuals tend to depend on external resources when they believe that these resources can perform certain tasks more efficiently than their own memory. Similarly, Sparrow, Liu, and Wegner (2011) [9] found that individuals may remember where information can be accessed rather than retaining the information itself. Generative AI extends this form of cognitive offloading by providing explanations, summaries, solutions, reasoning, and complete responses. Although such assistance can save time and reduce mental effort, excessive dependence on AI may decrease opportunities for students to think, recall, and process information independently.

Another important area of research concerns effortful processing and durable memory retention. Learning activities that require students to recall information, explain concepts, analyse problems, and solve questions independently are generally associated with deeper learning. Roediger and Karpicke (2006) [11] found that retrieval practice can improve long-term memory, while Bjork and Bjork (2011) [12] suggested that learning activities involving desirable difficulties can strengthen retention. In the context of Generative AI, excessive assistance may reduce students' opportunities to engage in these effortful learning activities. However, AI does not necessarily have a negative effect on memory. When Generative AI is used to create practice questions, provide feedback, explain difficult concepts, or support self-explanation, it may encourage active learning. Therefore, the effect of AI on memory retention may depend largely on the manner and purpose of its use.

Recent discussions have also highlighted the distinction between Generative AI use and Generative AI dependence. AI use involves employing AI tools as a supporting resource for academic activities, whereas AI dependence occurs when students regularly rely on AI to complete academic tasks with limited independent effort. A student may use AI to clarify a difficult programming concept or obtain feedback without becoming dependent on it. In contrast, continuously using AI to generate assignments, solutions, or answers without understanding the underlying concepts may indicate a higher level of dependence. Abbas, Jam, and Khan (2024) [13] highlighted academic workload and time pressure as important factors influencing students' use of Generative AI and discussed concerns related to procrastination, memory, and academic performance. These findings suggest that the impact of Generative AI cannot be determined solely by frequency of use; rather, the purpose, intensity, and nature of usage must also be considered.

Metacognition and self-regulated learning provide another important perspective for understanding AI-assisted

education. Metacognition refers to students' ability to understand, monitor, and evaluate their own learning, while self-regulated learning involves setting goals, planning study activities, monitoring progress, and modifying learning strategies when required. In an AI-supported learning environment, these abilities can help students determine when AI assistance is appropriate and evaluate whether they genuinely understand the information provided by the technology. Students with stronger self-regulation may use Generative AI as a learning support while continuing to practise independent recall, reasoning, and application. In contrast, students who rely heavily on AI without evaluating their own understanding may develop a false sense of learning and may retain less information over time.

Collectively, the existing literature indicates that Generative AI has both potential benefits and challenges for student learning. AI can reduce unnecessary mental effort, provide immediate assistance, and support personalised learning; however, excessive reliance may reduce active cognitive engagement and opportunities for effortful processing. The literature also suggests that metacognitive awareness and self-regulated learning may play an important role in determining whether AI becomes a useful learning tool or a source of excessive cognitive offloading. Therefore, further empirical investigation is required to understand how Generative AI usage and dependence influence students' learning behaviour and memory retention. This study attempts to contribute to this area by examining students' use of Generative AI and its perceived relationship with independent thinking, learning practices, and long-term retention.

3. RESEARCH GAP

Although Generative AI is increasingly being used by students for studying, assignments, research, problem-solving, and understanding difficult concepts, limited research has focused specifically on its impact on long-term memory retention and actual learning. Existing studies have mainly examined academic performance, productivity, and immediate learning outcomes, while less attention has been given to whether students are able to independently understand, recall, and retain information after using AI tools. There is also a need to understand whether frequent dependence on Generative AI leads to cognitive offloading and reduces students' effortful learning, critical thinking, and independent problem-solving abilities. Therefore, this study aims to examine the impact of Generative AI on memory retention and learning among students, with particular focus on AI usage, AI dependence, independent learning, understanding, and students' ability to retain information over time.

4. OBJECTIVES

The main objective of this study is to examine how dependence on Generative Artificial Intelligence (GenAI) affects students' memory retention and learning abilities. The study aims to understand whether excessive reliance on AI tools influences students' ability to remember information, understand concepts, and learn independently.

- To examine the relationship between Generative AI dependence and memory retention among students.
- To understand how excessive use of Generative AI affects students' ability to remember and recall information over time.
- To investigate the role of cognitive offloading in the relationship between AI dependence and memory retention.
- To analyse how different patterns of Generative AI usage, such as reflective, cautious, thoughtless, and collaborative use, influence students' learning and memory retention.
- To examine how students' self-regulated learning and monitoring of their own understanding affect the impact of AI dependence on memory retention.
- To compare students' perceived learning (how much they feel they have learned) with their actual memory retention.

4.1 Hypotheses of the Study

Based on the objectives of the study, the following null (H_0) and alternative (H_1) hypotheses are framed:

H_{01}: There is no significant relationship between overall Generative AI dependence and memory retention among students.

H_{11}: There is a significant relationship between overall Generative AI dependence and memory retention among students.

H_{02}: There is no significant relationship between frequency of Generative AI use and memory retention among students.

H_{12}: There is a significant relationship between frequency of Generative AI use and memory retention among students.

H_{03}: There is no significant relationship between Generative AI dependence and frequency of forgetting among students.

H_{13}: There is a significant relationship between Generative AI dependence and frequency of forgetting among students.

H_{04}: There is no significant relationship between the perceived reduced need to memorize (due to Generative AI) and memory retention among students.

H_{14}: There is a significant relationship between the perceived reduced need to memorize (due to Generative AI) and memory retention among students.

H_{05}: There is no significant relationship between independent problem-solving and memory retention among students.

H_{15}: There is a significant relationship between independent problem-solving and memory retention among students.

H_{06}: There is no significant relationship between understanding a topic before using Generative AI and memory retention among students.

H_{16}: There is a significant relationship between understanding a topic before using Generative AI and memory retention among students.

5. RESEARCH METHODOLOGY

5.1 Research Approach

This study adopts a quantitative research approach to examine the impact of Generative AI on memory retention and learning among students. The quantitative approach allows the researcher to collect and analyse numerical data from student responses.

5.2 Research Design

The study follows a descriptive and correlational research design. The descriptive design is used to understand students' patterns of Generative AI use, while the correlational aspect examines the relationship between Generative AI use, memory retention, and learning.

5.3 Population of the Study

The population of the study consists of students who use or have experience with Generative AI tools for educational purposes. The study focuses on students' experiences and perceptions regarding the use of Generative AI in learning. The study was conducted among students in the Navi Mumbai area, and the total number of respondents who participated in the survey was 123.

5.4 Sampling and Sampling Technique

The study uses a sample of students selected through convenience sampling. Students who were available and willing to participate in the study were included as respondents.

5.5 Data Collection Method

The study uses primary data collected through an online structured questionnaire using Google Forms. The questionnaire collects information about Generative AI usage, frequency of use, dependence on AI, learning experiences, and perceived memory retention.

5.6 Research Instrument

A structured questionnaire is used as the main research instrument. It consists of multiple-choice questions and Likert-scale statements designed to measure students' attitudes, experiences, and behaviour related to Generative AI, learning, and memory retention.

5.7 Data Analysis

The collected data is analysed using descriptive and inferential statistical techniques. Frequencies, percentages, and mean values are used to summarise the responses. Appropriate statistical tests are used to examine the relationships between Generative AI use, memory retention, and learning outcomes.

5.8 Ethical Considerations

Participation in the study is voluntary. Respondents are informed about the academic purpose of the study, and their responses are kept confidential. The collected data is used only for academic research purposes.

6. DATA ANALYSIS

The data collected through the Google Forms questionnaire was analysed using responses from 123 students. Frequency and percentage analysis was used to understand the respondents' demographic characteristics, Generative AI usage, AI dependence, memory retention, and learning patterns. Spearman's rank correlation was used for hypothesis testing because several variables were measured using ordered response categories.

6.1 Demographic Profile of Respondents

Table 1: Age Group

Age Group	Frequency	Percentage
Below 18	10	8.2%
18-20	55	45.1%
24-26	43	35.2%
Above 26	14	11.5%

Age Group	Frequency	Percentage
Below 18	10	8.2%
Total	122	**100%**

Table 2: Current Education Level

Education Level	Frequency	Percentage
Postgraduate	60	48.8%
Undergraduate	40	32.5%
Diploma	20	16.3%
Job	2	1.6%
Working	1	0.8%
Total	123	**100%**

Table 3: Generative AI Usage

Response	Frequency	Percentage
Yes	117	96.7%
No	4	3.3%
Total	123	**100%**

Table 4: Frequency of Generative AI Use

Frequency	Frequency	Percentage
Very Often	24	19.5%
Often	22	17.9%
Sometimes	37	30.1%
Rarely	15	12.2%
Never	25	20.3%
Total	123	**100%**

Table 5: Main Academic Activities for Using Generative AI

Academic Activity	Frequency	Percentage
Solving questions/problems	29	23.6%
Understanding difficult topics	25	20.3%
Writing Assignments	24	19.5%
Summarizing study material	24	19.5%
Research / Literature search	10	8.1%
Preparing presentations	8	6.5%
Everything	1	0.8%
Office Work	1	0.8%
Job Work	1	0.8%
Total	123	**100%**

Table 6: Memory Retention

Memory Retention	Frequency	Percentage
Very Well	20	16.3%
Well	17	13.8%
Moderately	49	39.8%
Poorly	15	12.2%
Very Poorly	22	17.9%
Total	123	**100%**

6.2 Hypothesis Testing

Spearman's rank correlation was used to examine the relationship between the major variables at a 0.05 significance level.

Table 7: Spearman's Rank Correlation Results

Hypothesis	Variables Tested	Spearman's ρ	p-value	Decision
H1	Overall, AI dependence and memory retention	0.066	0.466	Fail to reject H0
H2	Frequency of AI use and memory retention	0.267	0.003	Reject H0
H3	AI dependence and frequency of forgetting	-0.017	0.850	Fail to reject H0
H4	Reduce need to memorize and memory retention	0.186	0.039	Reject H0
H5	Independent problem-solving and memory retention	0.087	0.339	Fail to reject H0

Hypothesis	Variables Tested	Spearman's ρ	p-value	Decision
H6	Understanding a topic before using AI and memory retention	-0.045	0.626	Fail to reject H0

The hypothesis testing results show that out of six hypotheses, two null hypotheses (H_0) were rejected, while the remaining four were not rejected at the 5% significance level. A significant relationship was found between the frequency of Generative AI use and reported memory retention, as well as between the perceived reduced need to memorize and memory retention. However, no significant relationship was found for the other four hypotheses. Overall, the results suggest that the relationship between Generative AI use and students' memory retention varies across different learning behaviours.

6.3 Bar Chart

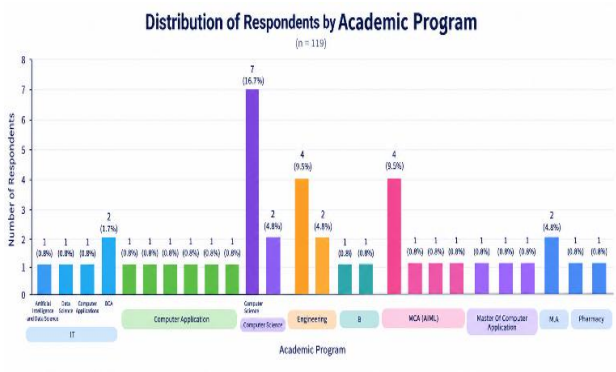


Fig 1: Number of Respondents along with academic program

The bar chart shows the distribution of respondents according to their academic program. The highest number of respondents were from Computer Science, with 7 respondents (5.9%). Engineering and MCA (AIML) each contributed 4 respondents (3.4%). A few respondents were from BCom and other academic programs, with most categories having 1–2 respondents. Overall, the chart shows that the respondents came from diverse academic backgrounds, with Computer Science having the largest representation.

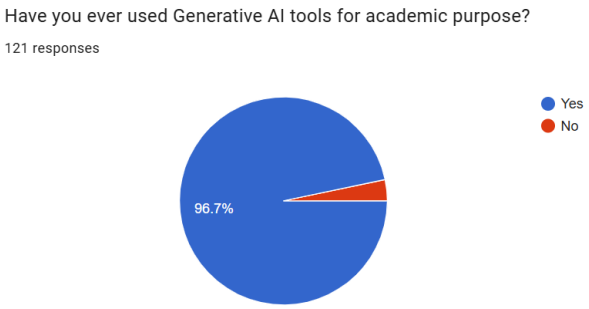


Fig 2: Usage of Generative AI Tools for Academic Purpose

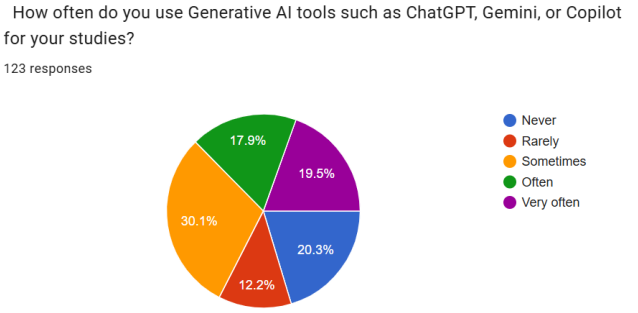


Fig 3: Often usage of Generative AI

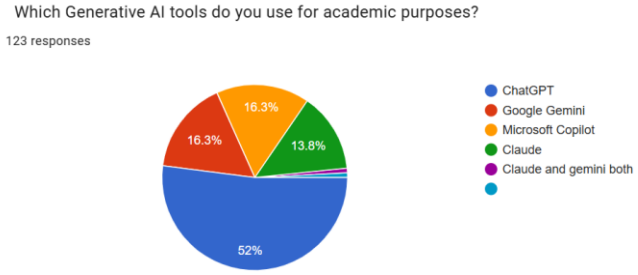


Fig 4: Tool mostly used for the academic purpose

Fig 5: Purpose of using Generative AI

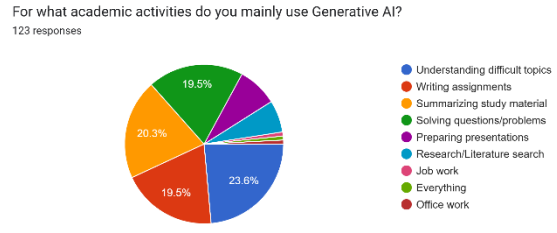


Fig 6: Advantage of using Generative AI

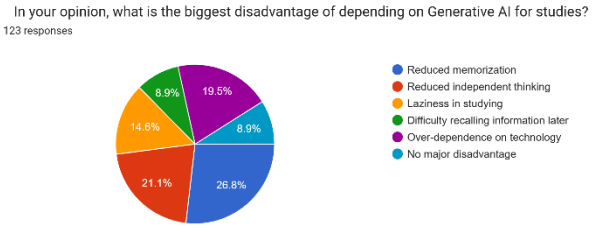


Fig 7: Disadvantage of using Generative AI

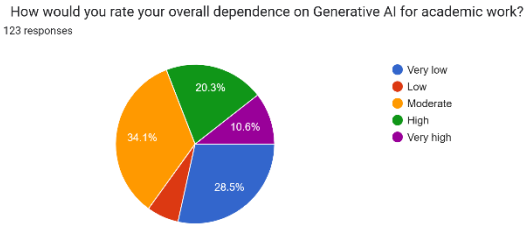


Fig 8: Overall Dependence of Generative AI

Overall impact of generative AI on students' pie chart

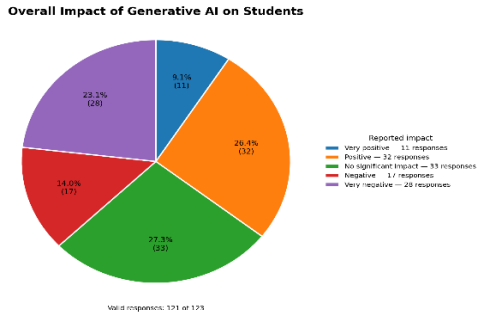


Fig 9: Overall Impact of Generative AI on the students

7. INTERPRETATIONS

The survey findings show that Generative AI is widely used by students for academic activities such as solving problems, understanding difficult topics, writing assignments, and summarising study material. While students find AI useful for saving time and improving understanding, excessive dependence may affect independent thinking and active learning. About 70% of respondents (69.9%) reported moderate or better memory retention. The statistical analysis showed that overall AI dependence was not significantly related to memory retention ($\rho = 0.066$, $p = 0.466$), whereas the frequency of AI use ($\rho = 0.267$, $p = 0.003$) and the perceived reduced need to memorize ($\rho = 0.186$, $p = 0.039$) showed significant but weak positive relationships with memory retention. Overall, Generative AI can be a useful learning support, but students should continue to engage in independent learning and revision for better retention.

8. DISCUSSION

The results of this study provide several important insights into the relationship between Generative AI use, learning, and memory retention among students. The finding that 96.7% of respondents use Generative AI for academic purposes, with 37.4% of students using it very often or often, shows that AI has become an important part of students' learning activities. Students mainly use AI for solving questions and problems and understanding difficult topics, indicating that Generative AI is primarily being used as an academic support tool rather than only for completing assignments.

The memory-retention findings show that 39.8% of students reported moderate memory retention, 30.1% reported retaining information well or very well (13.8% well and 16.3% very well), and 30.1% reported poor or very poor retention (12.2% poor and 17.9% very poor). This suggests that frequent AI use does not automatically result in poor memory retention, as students may use AI in different ways depending on their learning habits.

However, the correlation analysis presents an important finding: the overall relationship between Generative AI dependence and memory retention was not statistically significant ($\rho = 0.066$, $p = 0.466$). In contrast, the frequency of AI use showed a weak but significant positive relationship with memory retention ($\rho = 0.267$, $p = 0.003$), and the perceived reduced need to memorize was also significantly related to memory retention ($\rho = 0.186$, $p = 0.039$). No significant relationship was found between AI dependence and frequency of forgetting, independent problem-solving and memory retention, or understanding a topic before using AI and memory retention ($p > 0.05$). This indicates that overall dependence alone may not be sufficient to explain differences in students' memory retention. The way students interact with AI, their independent learning practices, and their level of dependence may therefore be more important factors to consider.

Overall, the findings suggest that Generative AI can provide valuable academic assistance, particularly for understanding difficult topics and solving problems, but its benefits should be balanced with independent thinking, active learning, and revision. The results support the view that Generative AI should be used as a learning support

rather than a complete replacement for students' own cognitive effort.

9. CONCLUSION

The study concludes that Generative AI has become an important part of students' academic learning, particularly for solving problems, understanding difficult topics, writing assignments, and summarising study material. The findings show that although students frequently use Generative AI, overall dependence on it does not have a statistically significant relationship with memory retention, although the frequency of use showed a weak but significant positive relationship. Therefore, the impact of AI on learning and memory depends not only on the frequency of use but also on how students use the technology and how actively they participate in the learning process.

1. Generative AI provides students with quick explanations, solutions, summaries, and assistance with difficult academic topics. The high level of AI usage among respondents indicates that students consider these tools useful for improving the convenience and efficiency of their learning.
2. The study found that most students reported moderate to good memory retention. However, overall AI dependence was not significantly correlated with memory retention ($p = 0.466$), while the frequency of AI use and the perceived reduced need to memorize showed significant but weak positive correlations ($p = 0.003$ and $p = 0.039$). This suggests that frequent AI usage alone cannot be considered a direct cause of better or poorer memory retention.
3. The findings highlight the importance of maintaining independent thinking and active participation while using Generative AI. Students should not completely depend on ready-made AI responses, as understanding, recalling, practising, and revising information remain important parts of effective learning.
4. Generative AI should be treated as a supportive learning tool rather than a replacement for students' own efforts. Responsible use, combined with independent study, revision, critical thinking, and self-evaluation, can help students gain the benefits of AI while maintaining effective learning and memory retention.

10. LIMITATIONS

The present study has the following limitations:

1. The study used convenience sampling and was limited to 123 students from the Navi Mumbai area, so the findings cannot be generalised to all students or to other regions.
2. The data was collected through a self-reported online questionnaire. Memory retention was measured through students' own perception rather than an objective memory or recall test, so responses may be affected by recall bias or overestimation of one's own learning.
3. The study used a cross-sectional, correlational design with Spearman's rank correlation. It shows the strength and direction of relationships between variables but cannot establish cause and effect.
4. Only the relationship between pairs of variables was tested. Other factors such as prior academic ability, study habits, type of AI tool, and self-regulated learning were not controlled for.
5. Six hypotheses were tested at the 5% significance level without any correction for multiple comparisons, and the two significant relationships ($\rho = 0.267$ and $\rho = 0.186$) were weak, so they should be interpreted with caution.
6. AI dependence and frequency of use were measured through self-rated questionnaire items rather than a standardised, validated dependence scale, and the reliability and validity of the questionnaire (for example, Cronbach's alpha) were not formally reported.
7. Respondents ranged from below 18 to above 26 years of age and included diploma, undergraduate, postgraduate, and working participants. These groups were analysed together, so differences by age or education level could not be examined.
8. Although the objectives refer to reflective, cautious, thoughtless, and collaborative AI use, the hypotheses tested only the frequency and overall level of dependence. The quality or manner of AI use, which the literature suggests is important, was therefore not directly measured.

11. FUTURE SCOPE OF STUDY

Based on the findings and limitations of this study, the following directions are suggested for future research:

1. Future studies can use a larger and more diverse sample drawn from multiple cities, institutions, and academic disciplines to improve generalisability.
2. A longitudinal or experimental design, including actual memory and recall tests conducted after a time gap, can

measure real memory retention instead of perceived retention.

3. Multivariate techniques such as regression analysis or structural equation modelling can be used to study the combined effect of AI dependence, cognitive offloading, usage patterns, and self-regulated learning on memory retention.

4. Qualitative methods such as interviews and focus groups can help understand how and why students use Generative AI, and how reflective, cautious, thoughtless, and collaborative usage patterns affect learning.

5. Future research can compare different AI tools and different groups of learners, and can test interventions such as AI literacy training and guided-use strategies that promote independent thinking and revision.

REFERENCES

[1] M. R. Rahman and M. S. W. Hossain, "Generative Artificial Intelligence and Its Impact on Education: Opportunities and Challenges," International Journal of Educational Technology, 2023.

[2] T. Tlili, B. Shehata, M. A. Adarkwah, A. Bozkurt, D. Burgos, and A. C. Agyemang, "What If the Devil Is My Guardian Angel: ChatGPT as a Case Study of Using Chatbots in Education," Smart Learning Environments, vol. 10, no. 1, 2023.

[3] E. Kasneci, K. Sessler, S. Küchemann, M. Bannert, D. Dementieva, F. Fischer, U. Gasser, G. Groh, S. Günnemann, E. Hüllermeier, S. Krusche, G. Kutyniok, T. Michaeli, C. Nerdel, J. Pfeiffer, A. Poquet, K. Sailer, A. Schmidt, T. Seidel, M. Stadler, J. Weller, J. Kuhn, and G. Kasneci, "ChatGPT for Good? On Opportunities and Challenges of Large Language Models for Education," Learning and Individual Differences, vol. 103, 2023.

[4] A. Dwivedi, N. Kshetri, L. Hughes, E. Slade, A. Jeyaraj, V. Kumar, M. Kar, A. Koohang, V. Raghavan, M. Ahuja, M. Albanna, A. Albashrawi, A. Al-Busaidi, J. Balakrishnan, Y. Barlette, S. Basu, A. Bose, C. Brooks, et al., "So What If ChatGPT Wrote It? Multidisciplinary Perspectives on Opportunities, Challenges and Implications of Generative Conversational AI for Research, Practice and Policy," International Journal of Information Management, vol. 71, 2023.

[5] M. Gerlich, "AI Tools in Society: Impacts on Cognitive Offloading and the Future of Critical Thinking," Societies, vol. 15, no. 1, 2025.

[6] S. B. Mahapatra, "Impact of ChatGPT on Learning and Academic Performance: A Study of Students' Use of Generative AI," Education and Information Technologies, 2024.

[7] A. A. Abdelwahab and M. A. Al-Ali, "Generative AI and Academic Learning: Students' Perceptions, Dependence and Learning Outcomes," International Journal of Educational Research, 2024.

[8] D. J. K. J. Risko and S. Gilbert, "Cognitive Offloading," Trends in Cognitive Sciences, vol. 20, no. 9, pp. 676–688, 2016.

[9] B. Sparrow, J. Liu, and D. M. Wegner, "Google Effects on Memory: Cognitive Consequences of Having Information at Our Fingertips," Science, vol. 333, no. 6043, pp. 776–778, 2011.

[10] D. N. Perkins, "Person-Plus: A Distributed View of Thinking and Learning," in Distributed Cognitions: Psychological and Educational Considerations, G. Salomon, Ed. Cambridge, U.K.: Cambridge University Press, pp. 88–110, 1993.

[11] H. L. Roediger III and J. D. Karpicke, "Test-Enhanced Learning: Taking Memory Tests Improves Long-Term Retention," Psychological Science, vol. 17, no. 3, pp. 249–255, 2006.

[12] E. L. Bjork and R. A. Bjork, "Making Things Hard on Yourself, but in a Good Way: Creating Desirable Difficulties to Enhance Learning," in Psychology and the Real World, M. A. Gernsbacher et al., Eds. New York, NY, USA: Worth Publishers, pp. 56–64, 2011.

[13] M. Abbas, F. A. Jam, and T. I. Khan, "Is It Harmful or Helpful? Examining the Causes and Consequences of Generative AI (ChatGPT) Usage Among University Students," International Journal of Educational Technology in Higher Education, vol. 21, art. 10, 2024.