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AI AND NOTE-TAKING: INVESTIGATING THE EFFECTS OF AI ON MEMORY RETENTION, STRESS, AND LEVELS OF PREPAREDNESS

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AI AND NOTE-TAKING: INVESTIGATING THE EFFECTS OF AI ON MEMORY
RETENTION, STRESS, AND LEVELS OF PREPAREDNESS

By

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A capstone project submitted for Graduation with University Honors

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ABSTRACT

Artificial intelligence (AI) use is becoming increasingly popular among students in higher education. Many students utilize AI to assist with tasks such as brainstorming, drafting, editing, summarizing information, studying, and note-taking. Of particular interest is understanding the ways that AI use can help or hinder note-taking. Previous research has shown that note-taking is beneficial to learning because it requires people to put information into their own words, which engages cognitive processes that allow them to gain a deeper understanding of the materials. Using AI can help students with summarizing the main ideas of the learning materials, which supports their learning process. Additionally, it may reduce their test-taking stress by making them feel more prepared for the exam. However, AI use may also hinder learning if it replaces the cognitive processes involved in note-taking. Therefore, this study addressed: 1) whether using AI to assist with note-taking is more effective at supporting learning than traditional note-taking, and 2) whether having support from AI during learning can alleviate potential stress and help students feel more prepared for an exam. In this study, participants read a passage and took a knowledge test under one of three conditions: control (read-only), note-taking, and AI-assisted note-taking (using AI to identify the main points of the passage in conjunction with their own notes). Then, participants answered questions about their levels of stress and preparedness given their test preparation method. I hypothesized that the note-taking group would have the highest memory performance because note-taking requires students to paraphrase the information, which supports memory retention. However, AI's ability to help students strengthen their notes could potentially allow the AI-assisted group to improve their performance relative to traditional note-taking. Additionally, I hypothesized that the AI-assisted group would experience less stress and feel more prepared than the other two groups, and thus, have better test performance due to

higher confidence levels in their knowledge of the content. However, using AI could also be more stressful since the information generated by AI might not be detailed enough to help students do well on the test. Contrary to my hypotheses, there was no significant difference in test scores or stress levels between the groups. However, the AI-assisted group reported feeling significantly more prepared for the exam than the read-only group. Though it is still unclear whether AI use is more beneficial or harmful to learning, this study was a critical first step in determining how AI use could potentially benefit students in higher education.

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INTRODUCTION

With the rise of accessible AI programs over the last few years, the use of AI has become increasingly common among students in higher education. The debate about whether AI is more beneficial or harmful to student learning is continuous. As new research is conducted, there is more supporting evidence for both viewpoints. On the one hand, AI usage can be harmful to learning if students depend too heavily on it to complete their work. For example, AI can hinder learning if students rely on it to summarize the main ideas of a reading instead of putting in the effort to understand the materials on their own. Students are not learning if they are not using their critical thinking and cognitive skills to try and understand the class materials. On the other hand, several research studies have found a positive link between AI use and student learning. For example, having AI support can potentially lessen cognitive overload, academic stress, and burnout to promote an improved, more positive approach to learning.

Many students struggle with taking effective notes. One of the reasons why students have a difficult time with note-taking is because students tend to take notes verbatim to the lecture slides. When students take verbatim notes instead of putting the information in their own words, they are not actively engaging in the mental processes that deepen their understanding of the content. Some students may feel the need to write down everything mentioned on the lecture slides because they have trouble identifying the main points of the lecture.

Students have a hard time differentiating important information from less important details because they don't know what to focus on (Baker & Lombardi, 1985). In a classroom setting, note-taking can sometimes be a challenge for students because they are simultaneously balancing multiple tasks. As they listen to the professor talk, they are also trying to understand the information on the slides, and draw out key information from the lecture to write down at the

same time. Having to multi-task while taking notes makes it harder for students to home in on the important information, and thus, causes them to miss key ideas or record details that are not worthy of mentioning.

Additionally, sometimes the professor mentions information that isn't on the lecture slides, and it is difficult to note all the main points that were mentioned because the average talking speed is much faster than the average writing speed. As a result, students sometimes have gaps in their notes because the professor has already moved on to the next topic before they can note down the key information from the previous section. Having to process, analyze, and write down information simultaneously in a fast-paced lecture can contribute to ineffective note-taking (Piolat et al., 2005).

There is a trade-off that occurs between note-taking and comprehending the lecture content, as this is essentially a multitasking scenario. Students focused on taking notes are essentially engaged in a transcribing process, so they won't be able to fully comprehend the class materials. On the other hand, if students are focused on understanding the class materials instead of taking notes, they will miss out on writing down important information within the lecture. In some instances, students may find themselves fixated on the transcription process and may not fully engage in the deeper level of processing that would support them in fully understanding the materials. Finding a balance between these two tasks is difficult, especially when lectures are set up in a way where students are required to multitask and engage in both processes.

Note-taking is a process that takes up a lot of cognitive energy because there are multiple mental processes occurring simultaneously (Piolat et al., 2005). Therefore, having an external support tool like AI can potentially help students enhance their note quality. AI tools can make note-taking easier by assisting students with summarizing the main ideas of a complicated topic.

Some students may benefit from having support with summarizing the text they read, especially the ones that are complicated or difficult to understand. Utilizing AI for note-taking can make learning more efficient because it lessens the cognitive load placed on students to read, summarize, and understand the main points of a reading. Therefore, this current study aims to evaluate whether AI-assisted note-taking can be more beneficial than traditional note-taking.

AI Use in Education

AI usage, especially in higher education, has become extremely popular. Students are using this tool for all sorts of tasks including brainstorming, writing, and checking their own work. Although the use of AI can be helpful for students to improve their work, many students can hinder their academic learning if they over rely on this tool.

Some research has shown that utilizing AI within education can support student learning. Olugbade et al. (2024) found that using AI as a tutor for middle school students lessened their cognitive load (i.e., the amount of mental information students needed to juggle), which improved learning outcomes. The researchers found that AI helped students learn better because the learning experience was personalized to each individual depending on their strengths and weaknesses. For example, students were able to ask the chatbot for clarification on specific topics within the curriculum that they were struggling with. When comparing the performance of students with and without AI assistance, the group with AI assistance performed better academically and displayed more positive attitudes towards learning. Additionally, Hwang et al. (2020) discussed how AI is a learning tool because it acts as a tutor that helps students learn asynchronously. Online learning can be easier for students with the help of AI since students can receive immediate feedback and clarification on difficult topics even in the absence of the

instructor. Following this logic, AI could also help students improve their note-taking skills by targeting specific areas of the students' notes where there is key information missing.

Other research indicates that AI assistance does more harm than good in regards to student learning. Schön et al. (2023) discovered that AI tools are disruptive to student learning and the education system. Specifically, AI is harmful because students are using it to complete their work instead of using their own knowledge. This study calls for new methods of teaching and learning as well as ethical ways to utilize AI for learning. Rudolph et al. (2023) found that in addition to utilizing AI tools, students can also use AI to make their work appear more human to avoid plagiarism checkers. These studies call for an ethical examination of AI usage within education. By studying whether AI-assisted note-taking could improve memory retention and lower stress, this study examines a potential way to ethically and effectively utilize AI to support students' learning.

Some studies, such as the systematic review of ChatGPT in higher education conducted by Abdallah et al. (2025), indicate that there are advantages and disadvantages with using AI. Utilizing ChatGPT in an academic setting supports students with comprehending the course materials but if students over rely on this tool, it can decrease their critical thinking and analytical skills. Incorporating teaching methods such as letting students review or fix ChatGPT output helps students utilize the tool in a way that supports their learning while maintaining their critical thinking skills. Moreover, this systematic review discovered that there is a positive correlation between ChatGPT usage and reduced anxiety in addition to increased self-efficacy. Having AI assistance during the learning process increases confidence, which in turn increases performance. However, in the case of over-reliance, ChatGPT usage can cause technostress and emotional fatigue. Thus, researchers urge institutions to provide students with guidance on

digital wellbeing and stress the importance of utilizing AI in moderation. This finding is highly relevant to the current study because using AI to support note-taking may reduce test-taking stress and anxiety. Because AI usage has become extremely popular within education, and especially higher education, the current study provides a way in which students can incorporate AI tools into their learning to enhance academic outcomes. It aims to determine a way in which students can benefit from AI without excessive reliance on the tools to complete their work.

AI & Note-taking

The current study examines ChatGPT as a learning tool to support note-taking. Previous studies have shown that there are multiple benefits to traditional note-taking. Di Vesta and Gray (1972) concluded that note-taking resulted in better memory retention due to the deeper level of processing that occurs when students take notes. Additionally, students benefit from having notes that they can look back on and review. AI can support note-taking by providing assistance with summarizing the key ideas of a reading, which helps students focus their studying and learning on the important concepts. Using AI to assist with note-taking is an ethical and effective way to enhance learning because students still engage in reading and note-taking, while AI helps them with summarizing the main ideas that they may have overlooked.

The method of note-taking students use also makes a difference in learning. In higher education, it is becoming increasingly common for students to take notes on their laptops instead of in longhand. Mueller and Oppenheimer (2014) discovered that taking notes on laptops is less effective for learning than longhand note-taking. Even when students use laptops solely for note-taking, they don't process the course materials as deeply as longhand note-taking students (but see Weichmann et al., 2022). Laptop note-takers tend to type lecture notes verbatim instead of processing and putting the information in their own words. Therefore, students who take notes

via laptops experience poor information processing, and thus, perform worse on conceptual questions than their longhand note-taking peers. Since the current study is conducted online, the way information is encoded and recalled may be influenced since participants had to take notes digitally. AI might be able to compensate for the downside of notetaking because it fills in gaps within students' knowledge. However, with AI usage, students would not be engaging in the cognitive processing needed to learn new information, which limits the growth of their learning.

On the other hand, some research indicates that note-taking benefits differ depending on certain factors. Jansen et al.'s (2017) study showed that the way information is presented, different note-taking methods, and each person's cognitive skills all play a role in whether or not note-taking is beneficial. The study explained that since note-taking requires students to put information into their own words, it uses their cognitive ability, which is a limited resource. Since note-taking requires cognitive ability, it can affect how much of this cognitive resource students have left to process the information while they take notes. Having a tool such as AI can assist students who may struggle with the note-taking process. Particularly, it can reduce the effort required to summarize information, allowing more cognitive space to be available for processing the information.

The Current Study

While there has been much research conducted on AI use and note-taking separately, few studies investigate these two topics together. The proposed study will examine whether traditional note-taking or AI-assisted note-taking will result in better cognitive performance and memory retention. AI's assistance in reviewing students' notes could potentially aid students in summarizing the main points of a reading and help them perform better on assessments. Additionally, AI assistance during the note-taking process could alleviate potential exam-taking

stress that students may encounter because they have additional support in understanding the materials. This research project examines a way in which AI can be used ethically within higher education to support student learning and nurture academic success. It will contribute to existing and future research that aims to navigate the use of AI in ethical ways to make the most of the tool's potential ability to enhance academic learning outcomes. The current study examined the participants' test performance and stress levels under three different conditions: read-only, note-taking, and AI-assisted note-taking. I hypothesized that the AI-assisted group would have the best test performance and experience the least amount of stress out of all three conditions.

METHODS

Participants

My sample of participants consisted of 145 students from University of California, Riverside. The participants were recruited online via the UCR SONA research system. Participants in this research system were enrolled in undergraduate psychology courses that granted them partial course credit for participating in the study. Even though my sample originally consisted of 145 participants, 21 of them were excluded from the final analyses because they did not follow instructions. Of those 21 participants, one person did not partake in any of the activities after consenting to participate, one person took notes but did not respond to the test or survey, one person copied and pasted their notes as the answer to all of the test questions, 13 participants did not take notes, two participants in the AI-assisted group did not include ChatGPT's response, and three participants did not take notes nor included ChatGPT's response. When necessary, additional participants were recruited to ensure there was a sufficient amount of data approximately distributed equally across each group, resulting in a total of 123 participants. I obtained IRB approval (HS #19-281) prior to starting this research project.

Materials and Measures

In all three conditions, participants were asked to read the same passage that describes the life of Leonardo da Vinci. The passage was three pages long and took approximately 5 minutes to read. This passage was selected because it has been used in prior work (James & Storm, 2019). Additionally, a distractor task was used to separate the learning phase from the testing phase. The distractor task was a Bubble Shooter game, and its purpose was to divert the participants' attention from the information they learned. The distractor task helped the knowledge test accurately measure the participants' memory retention of the content, and not whether the information is still stored in the participants' working memory. The participants were then given a knowledge test consisting of 8 fill-in-the-blank questions (i.e., Leonardo daVinci is said to epitomize the term _____, Answer: Renaissance man). The test was scored using a strict answer key. Only answers that matched the answer key were marked as correct. All spelling errors and synonyms were scored as incorrect. Upon completion of the knowledge test, participants filled out two Likert scales that asked them to rate their feelings of stress and preparedness from 1 (low) to 5 (high). The Likert scales consisted of two questions: 1. On a scale of 1 (not stressed at all) to 5 (extremely stressed), rate the level of stress you experienced during the test portion and 2. On a scale of 1 (not prepared at all) to 5 (extremely prepared), rate how prepared you felt for the test.

Procedure

The study was conducted via Qualtrics and participants completed it online and asynchronously. Participants who signed up for the study were taken to a Qualtrics survey where they were presented with a consent form detailing a brief description of the study, potential benefits and risks, how their data will be kept confidential, and an option to withdraw from the

study voluntarily. If participants chose to participate, they were randomly put into one of three conditions: control (read-only), note-taking, and AI-assisted note-taking. Those in the control group were asked to read the passage only. Those in the note-taking group were asked to read the passage and take notes on important information. The AI-assisted note-taking group were asked to read the passage, take notes on important information, and input the passage along with their notes into ChatGPT to receive feedback. The prompt participants gave to ChatGPT is “Give me feedback on how well I identified the main points of this passage.” After receiving feedback, students could review the feedback alongside their notes to enhance their understanding of the passage before taking the test. Students in the AI-assisted group were asked to paste the response given by ChatGPT into the Qualtrics form. After this stage, all participants were asked to play a Bubble Shooter game for five minutes which acts as a distractor task. Following the distractor task was the knowledge test where participants answered questions based on the passage they read about Leonardo da Vinci. Finally, the participants were presented with a survey that asked questions regarding their feelings of preparedness and stress levels during the test. The entire study took approximately 30 minutes to complete.

RESULTS

To analyze the test scores of the read-only, note-taking, and AI-assisted note-taking groups, a between-subjects one-way ANOVA was conducted. The analysis revealed no significant difference between performance in the read-only group ($M = 2.95$, $SD = 2.11$), the AI group ($M = 3.63$, $SD = 2.34$), and the note-taking group ($M = 3.03$, $SD = 2.30$), $F(2,120) = 1.14$, $p = .32$ (See Figure 1).

Figure 1

Between-Subjects One-Way ANOVA for Test Scores

Group Descriptives

	Condition	N	Mean	SD	SE
Test Score	AI-assisted	43	3.63	2.340	0.357
	Read-only	41	2.95	2.109	0.329
	Note-taking	39	3.03	2.300	0.368

Note. This figure shows the descriptive values for the AI-assisted, read-only, and note-taking groups' test scores.

When the stress ratings for the ready-only, note-taking, and AI-assisted groups were analyzed with a between-subjects one-way ANOVA, the analysis revealed no significant difference between the stress levels felt by the three groups (See Figure 2).

Figure 2

Between-Subjects One-Way ANOVA for Stress

Stress	AI-assisted	43	2.77	1.065	0.162
	Read-only	41	3.17	1.302	0.203
	Note-taking	39	3.15	1.159	0.186

Note. This figure shows the descriptive values for the AI-assisted, read-only, and note-taking groups' test-related stress levels.

To analyze how prepared each group felt about the test given their preparation method, another between-subjects one-way ANOVA was conducted. The analysis revealed a significant difference between the conditions, $F(2, 120) = 3.83, p = .02$. Post hoc comparisons revealed that participants in the AI-assisted condition felt significantly more prepared ($M = 2.88, SD = 1.26$) than participants in the read-only condition ($M = 2.27, SD = 1.03$) (see Figure 3). No other comparisons were significant.

Figure 3

Between-Subjects One-Way ANOVA for Preparedness

Preparedness	AI-assisted	43	2.88	1.258	0.192
	Read-only	41	2.27	1.025	0.160
	Note-taking	39	2.36	0.986	0.158

Note. This figure shows the descriptive values for the level of preparedness felt by the AI-assisted, read-only, and note-taking groups.

DISCUSSION

The current study examined whether using ChatGPT to assist students with note-taking would be better at supporting learning than traditional note-taking. Additionally, the study assessed whether having AI support would reduce test-related stress and improve feelings of preparedness for the exam. Contrary to my predictions, there was no significant difference in test scores between those who had support from AI and those who didn't. Moreover, between the AI-assisted, note-taking, and read-only groups, there was no significant difference in stress levels. However, there was a significant difference in the preparedness levels between the AI-assisted and read-only condition, such that participants felt more prepared for the test when they used AI to help them with their notes. Having utilized ChatGPT as part of their test preparation method, the AI-assisted group felt significantly more prepared for the test than the read-only condition.

The absence of test score differences between students supported by AI and those who were not could be explained by insufficient review time. Note-taking and having time to review the notes are crucial to memory retention (Di Vesta & Gray, 1972). Students in the note-taking group were asked to take notes and perform a distractor task before taking the knowledge test. For those in the AI-assisted condition, they took notes, utilized ChatGPT for feedback on their notes, and performed the distractor task. Across the different conditions, especially for those in

the note-taking and AI-assisted groups, there may not have been enough time allocated for students to review their notes, which could have hindered memory retention.

Another explanation for the lack of difference between test scores of the AI-assisted and non-AI-assisted groups could be the fact that it is an online study and students may have taken notes by copying the passage instead of putting it in their own words. Participants in all three conditions demonstrated poor performance overall, which suggests that the participants were not engaging in behaviors that supported their learning. The literature suggests that longhand note-taking is more effective for learning than taking notes on laptops. Additionally, students who take notes on laptops tend to copy notes verbatim to the course material (Mueller and Oppenheimer, 2014). This finding is especially relevant to the current study because students were requested to take notes via their laptops. Thus, the digital style of note-taking required in this study could have reduced retention overall, resulting in floor effects. Moreover, some students in the study copied and pasted certain sentences from the passage into their notes, which could have reduced their memory retention ability. When students take verbatim notes, they are not actively putting information into their own words, which weakens their ability to encode and store information. Hence, their performance could have been hindered due to the format of the study and their note-taking style.

An alternative rationale for the absence of test score differences could have been limited cognitive resources among participants during the note-taking process. Previous studies have shown that since note-taking uses cognitive ability, it may limit the cognitive availability for simultaneous information processing (Jansen et al., 2017). In this study, students were expected to take notes and review it simultaneously. Perhaps students had limited cognitive capacity to review and process their notes after taking them, which may not have been overcome by the use

of AI. This could have contributed to subpar performance on the knowledge test across all groups.

Another measure that did not differ significantly between groups is stress. A possible explanation for the absence of stress level differences could be the difficulty of the knowledge test. Since the test consisted of fill-in-the-blank questions, students had to actively recall the materials and generate the answer, including accurate spelling, which could explain the moderate amount of stress placed on students across the three groups.

Interestingly, the AI-assisted group felt significantly more prepared than the read-only group even though there were no significant differences in test scores across the three groups. This finding is consistent with previous research indicating that utilizing AI tools like ChatGPT reduces anxiety, and in return, improves feelings of preparedness (Abdallah et al., 2025). Since ChatGPT helps students feel better prepared for tests, it indicates that AI tools can be helpful for learning when it comes to providing students with a sense of self-confidence and self-efficacy. However, feeling more prepared without a measurable increase in performance can indicate metacognitive miscalibration, in which students perceive higher confidence in their knowledge but fall short in terms of actual performance. This explanation is consistent with previous studies indicating that students have poor metacognition when it comes to determining their expected grade versus their actual grade for an exam (Vadhan & Stander, 1994). Having support from AI can enhance feelings of preparedness without necessarily improving performance itself.

Limitations and Future Directions

One of the major limitations of this experiment was insufficient review time after students had taken notes. Because note-taking and review time were combined into one 10-minute period, students may not have had enough time to review in those 10 minutes. The AI-

assisted condition had to take notes, ask ChatGPT for feedback regarding their notes, and review the feedback so they could have benefited from having more review time. Additionally, students could benefit from partaking in longhand note-taking instead of taking notes on laptops. Future studies should provide a separate time for reviewing after note-taking to ensure adequate time and cognitive availability for information processing. Moreover, they should incorporate longhand note-taking to determine whether it will help with memory retention and lead to a difference in test scores among the AI-assisted and non-AI-assisted groups.

Another limitation of this study is that the quality of notes was not measured. Since some students had copied notes from the passage verbatim, it could have hindered their ability to encode and store information. Hence, future work should encourage students to put information into their own words when taking notes in addition to tracking the quality of students' notes. Future work could also measure the extent to which students took verbatim or paraphrased notes and use that as an individual differences variable to see how it interacts with AI use to support or hinder learning.

Finally, the test scores across the groups were relatively low, which indicated that the test may have been challenging for students. Having fill-in-the-blank questions may have been more difficult for students because it required them to generate an answer as opposed to just recognizing the answer. To remedy this, future studies should incorporate different assessment types such as multiple choice or true/false questions to examine whether the findings change or replicate across different types of assessment.

CONCLUSION

Overall, this study examined whether AI-assisted note-taking is more effective for learning and memory retention than traditional note-taking. Simultaneously, it aimed to discover

whether AI-assisted note-taking reduces stress and improves feelings of preparedness among students. Although no significant differences in test scores and stress levels were observed across the three groups, the AI-assisted note-taking group felt significantly more prepared for the test than the group that read the passage only. This finding indicates that AI tools provide students with confidence and self-efficacy, demonstrating the need for future studies to investigate how using these AI tools can translate confidence and self-efficacy into measurable improvements in test performance.

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