Paper Based Note-Taking vs. Typing Notes

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Abstract

The purpose of this experiment was to answer the following question: Which method of note-taking is more beneficial for learning: paper-based or online? This experiment examined a traditional method (handwritten) compared to a more recent, technological method (typed). The scientific hypothesis was that if note-taking was handwritten on paper (control group), then academic performance will be higher compared to notes that are typed (independent variable group) on an electronic device. This experiment was important in determining the effectiveness of each method. The results of this experiment can aid students in their academic studies. The procedures for this experiment involved IRB approval and creating a human informed consent statement. Afterwards, 2 surveys were created: a general survey about note-taking preferences and an assessment survey. A total of 100 participants, who were all high school students, were asked to complete the general survey, and 32 participants were randomly assigned a note-taking method and watched a Morse Code video while taking notes. After taking notes, the participants were instructed to study their notes and complete the assessment. A t-test was conducted to compare the means of the handwritten and typed methods. Additionally, the results from 2 questions regarding note-taking preferences were compared through the use of pie charts as a visual aid. The data was significant and the hypothesis — handwritten notes result in higher academic performance — was supported.

Keywords: handwritten, typed, note-taking methods

Introduction

Note-taking is essential in education. Students take notes for various purposes: studying for an exam, recording information learned in class, and to be actively engaged (Dartmouth, n.d.-b). In fact, studies have shown that 99% of college students have taken notes (Banke, 2016). Note-taking is widely used throughout various levels of education, and at some point, students will have to learn how to take effective notes in order to comprehend the material. When taking notes, the brain is actively working to process and encode information into memory. The person is alert and focused on the information presented, and taking notes allows them to organize and emphasize certain information (University of North Carolina, 2018). With this being evident, these notes can be used as a concise form of studying because it outlines major ideas or points that can be reviewed a numerous amount of times (*Benefits of Notetaking? | Student Skills Workshops*, 2019).

While taking notes is beneficial, there are different ways of doing so. The two main methods include paper-based and typing/digital note-taking. Note-taking on paper, also known as the traditional method, requires an individual to record information through active writing, while note-taking online involves typing on a keyboard and recording information digitally. As education leans more towards digitally-based applications, students have tended to rely on digital note-taking through recent years of the COVID-19 pandemic and asynchronous learning (Krishna, 2022). Both methods have their advantages and disadvantages. For example, the paper-based method results in higher retention of information compared to low retention from the typing method. When writing notes by hand, students have to actively summarize the information that they are given, and then encoding that to their hippocampus. The act of writing contributes to priming, or the association of information of ‘where’ and ‘what.’ Information can

then be retrieved in the hippocampus of the temporal lobe, the part of the brain where learning and memory retention occurs (Ibáñez, 2021). However, the typing method records more information than writing, and edits can be easily made to these notes.

With so many options available for note-taking, there is difficulty in choosing the most effective method. The purpose of this experiment is to answer the following question: Which method of note-taking is more beneficial for learning: paper-based or online? The scientific hypothesis is that if note-taking was handwritten on paper, then academic performance will be higher compared to notes that are typed on an electronic device. This experiment is important in determining the effectiveness of each method. The results of this experiment can aid students in their academic studies. There are also reasonable controls for this experiment, including the school setting and that the participants will be high-school students. The control group is the paper-based method, while the independent variable is the online-typing method. The dependent variable is assessment scores. A survey will be given to 100 students and will ask about their GPA and preferred method of note-taking. Furthermore, a sample of 32 high school students ranging from grades 9-12 will be apart of the experiment. Then they will be randomly assigned to either method to eliminate any bias. The content will be presented via Google Slides or a video on a topic that isn't commonly known. An assessment will be given, and the results will be compared and analyzed through a 2-sample t-test.

In a published research study called "Information Comprehension: Handwritten vs. Typed Notes," a group of 72 college students participated in an experiment that compared written and typed note-taking methods. The experimentation process for the study was thorough and specific, an indicator that this experiment needs to be clear and precise. The experiment included consent forms and proceeded to show a 10 minute documentary, where students took

notes with their assigned method. After, they took a comprehension test that was 10 questions and multiple choice, followed by a survey. The results accepted the hypothesis that written notes were the 'best' practice (Duran & Frederick, 2013). In another research study called "A Comparative Study of Handwriting and Computer Typing in Note-taking by University Students," a sample consisting of college students were divided into groups based on their preferences. The assignment of groups differs from this experiment's random assignment and could be an important factor in the results. The experiment consisted of more than one task of note-taking, including verbal, repetitive, and memorizing activities. The experiment also described the brain's processing (superficial and deep) of information and converting it into memory, a useful component for understanding how humans learn and memorize (Aragón-Mendizábal et al., 2016). The results of the experiment varied, since both methods had advantages and disadvantages in certain tasks. In conclusion, the research studies illustrate a well-organized experiment and offer insightful results. This experiment will aim to determine the most effective method of note-taking, except that the results will be based on random assignment of participants into each respective group, a difference from both studies.

Methodology

The focus of this project was to determine the effectiveness of note-taking by hand versus note-taking by typing. The hypothesis was the following: if note-taking is handwritten on paper, then academic performance will be higher compared to notes that are typed on an electronic device. Qualifications for an electronic device included any laptops or computers with a keyboard. The independent variable of this experiment was the online-typing method. The control group was the paper-based method, and the dependent variable was the assessment scores. The note-taking topic was a subject that wasn't well known by the participants and was presented in the form of a presentation or video.

Prior to conducting the experiment, a general survey via Google Forms was given to 101 high school students and asked about their GPA, note-taking preferences, and other detailed questions on their academic routines. There was a scale to gauge the responses, and high school students were specifically asked to be participants so that the experiment could be consistent overall.

Since it would've been difficult to conduct a note-taking and assessment experiment on 100 students, 32 high school students were the participants. Prior to conducting the experiment, a consent form was filled out by the participants so that they were aware of any necessary details. When students took the assessment survey, participants recorded their information on a Google form. This was recorded attendance as names remained anonymous to conform with participant rights. Using an online random generator, participants were assigned to either the independent variable group (online-typing method) or the control group (paper-based method). By incorporating this method, experiment bias was minimized because of random assignment.

After assigning the method, participants were instructed to have paper, a writing utensil, or a device if needed. Then, the participants were told to watch a video that was 10-15 minutes long while they were taking notes. No other resources were provided to reduce factors that would affect participant performance. After watching the video, students had 15 minutes to review their notes in order to prepare for the 10-minute assessment. The assessment consisted of a 10 question multiple choice questions that was taken on an electronic device by all participants. During the assessment, participants weren't allowed to access any of the notes that they took on the subject. The assessment scores were based on accuracy (# of correct questions answered divided by total questions). Afterwards, the results were compiled on a spreadsheet and analyzed through a 2 sample t-test. The analysis was a comparison between assessment scores of both methods, the p-values, and if the experiment rejected or accepted the null and alternative hypotheses.

Data & Results

Figure 1

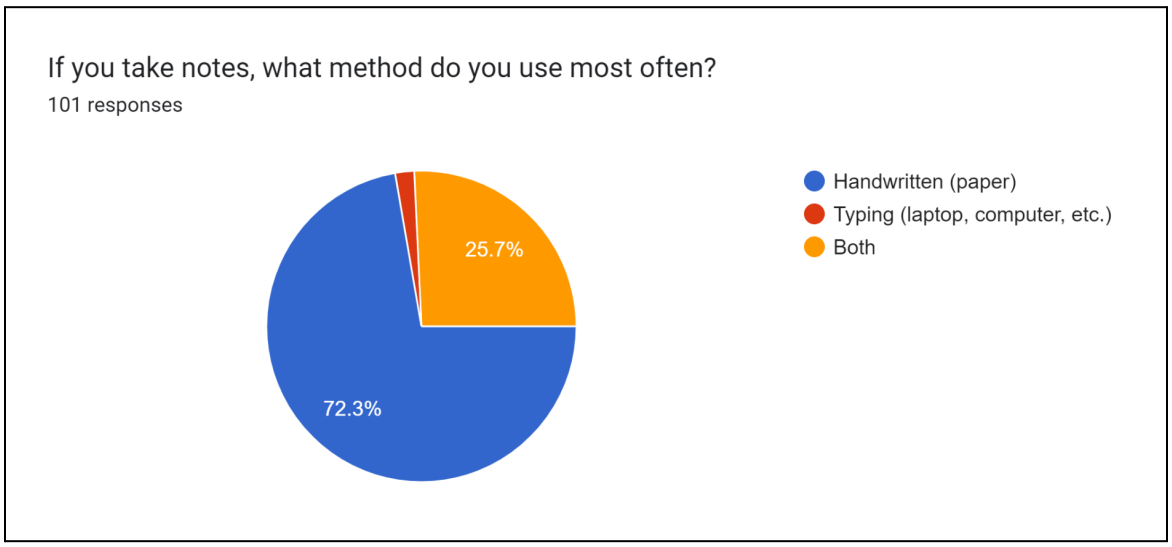
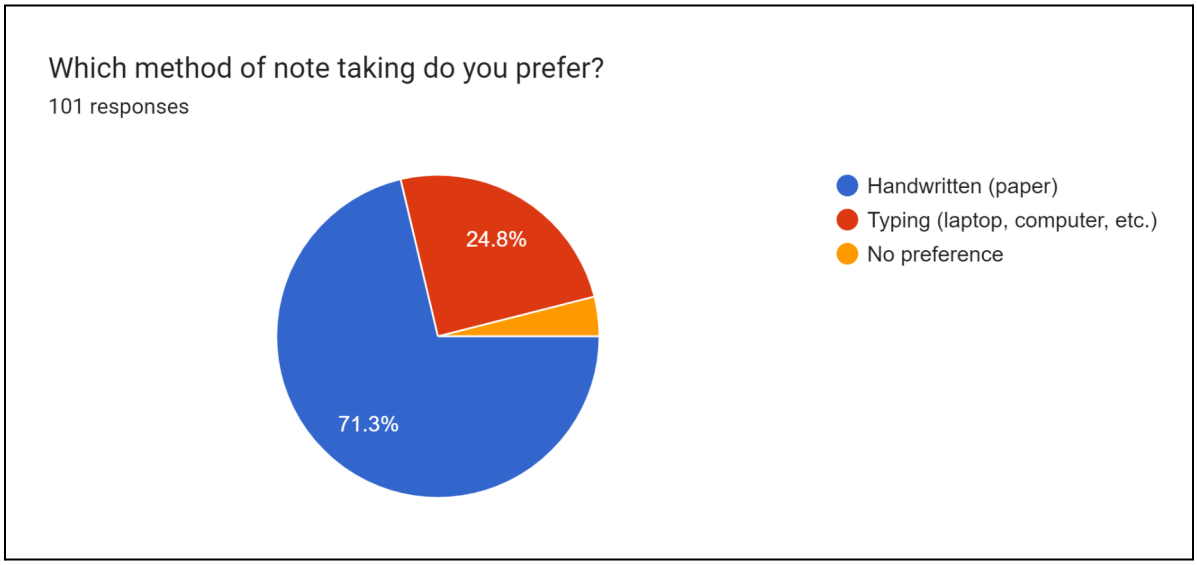


Figure 2



Figures 1 and 2 are pie charts that show the results of 2 questions from an initial survey that asked 101 students about their note-taking preferences. The Figure 1 question asks about the method that students apply most often. On Figure 1, 72.3% or 73 of the students used the handwritten method compared to the 2% or 2 of the students that used the typing method. In

addition, 25.7% or 26 of the students used both methods. The Figure 2 question asks about the method that each student preferred. The results are as follows: 71.3% or 72 of the students preferred to take handwritten notes, 24.6% or 25 of the students preferred to take notes by typing, and 4.1% or 4 of the students had no preference. On both questions, the handwritten method was the main choice. Although this initial survey is a minor component of the note-taking experiment, it is an indicator that students prefer and use the handwritten method more often when taking notes.

Table 1

Table 1: Paper-Based Note-Taking vs. Typing Notes		
Methods	**Control - Handwritten**	**Typed**
Mean	**7.5625**	**5.6875**
Standard Deviation	**1.498697351**	**1.99119154**
1 SD (68% Band)	**7.1875 - 7.9375**	**5.1895 - 6.1855**
2 SD (95% Band)	**6.9465 - 8.1785**	**4.8685 - 6.5065**
3 SD (99% Band)	**6.5975 - 8.5275**	**4.7115 - 6.6635**
Results of t test		**t = 2.91386 p = 0.003343**
For all:		**significant**
Degrees of Freedom:	**15**	**15**
Alpha = 0.05		

Figure 3

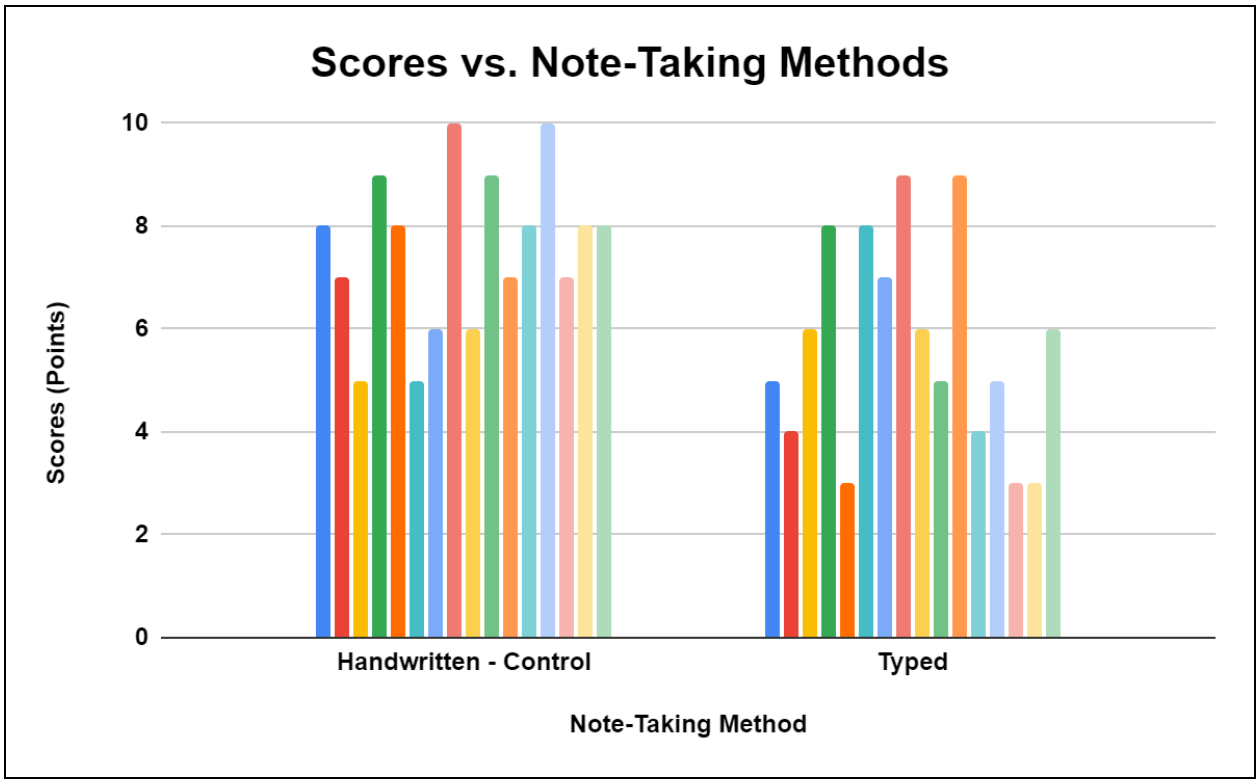
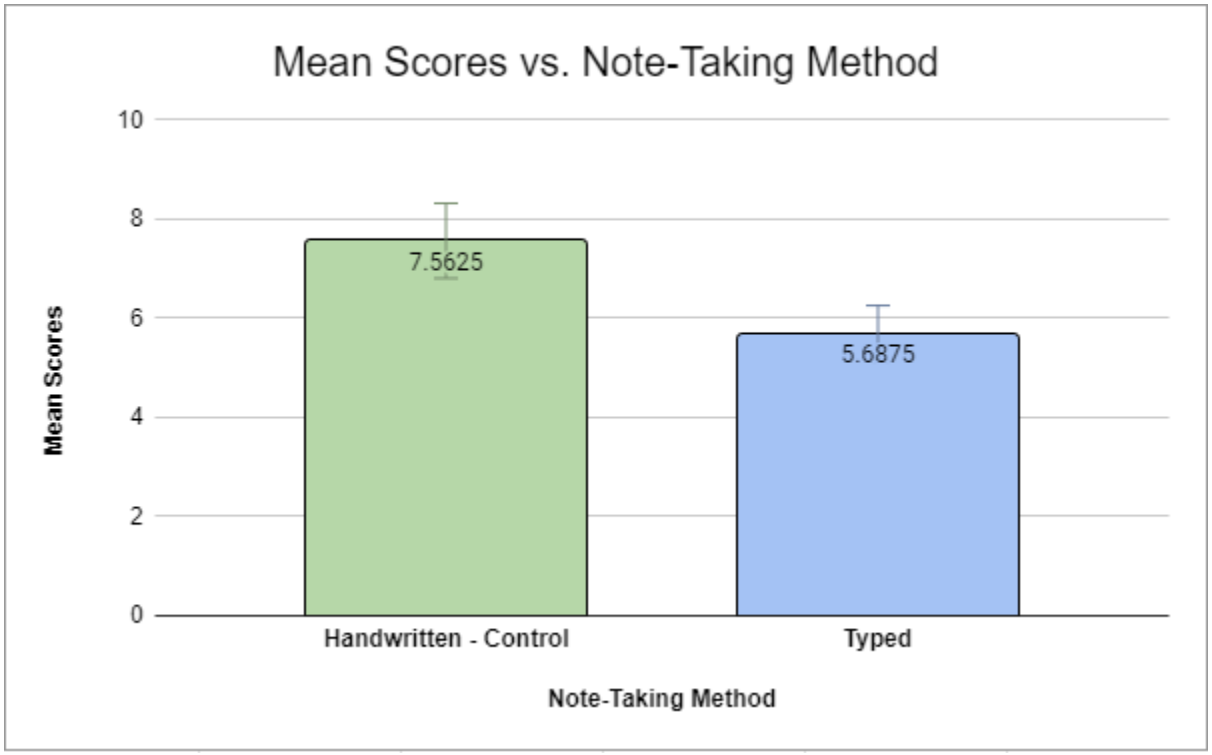

Scores vs. Note-Taking Methods
Scores (Points)
10
8
6
4
2
0
Handwritten - Control
Typed
Note-Taking Method

Figure 4


Mean Scores vs. Note-Taking Method
Mean Scores
10
8
6
4
2
0
7.5625
5.6875
Handwritten - Control
Typed
Note-Taking Method

The mean scores of the note-taking assessment in each method is presented in descriptive statistics of Table 1. A total of 32 participants completed the assessment. Figure 3 is a graphical representation of individual scores (out of 10 total points) vs note-taking method. Each method has 16 participant scores, with 16 varying colors, resulting in a total of 32 scores. The handwritten (control) group had the 3 highest scores (10 points), while the typed group had the 3 lowest scores (3 points). As indicated in Table 1, where a t-test was performed, the scores under the typed group had a significantly lower average (5.6875) than the scores in the control (handwritten) group (7.5625). Figure 4 is a graphical representation of the mean scores of both groups. As displayed, the error bars don't overlap, which means that there is a possibility that the data is significant. The error bars were representative of a 95% confidence interval. The standard deviation of the typed group was roughly 1.99, while the standard deviation of the control group was roughly 1.498. The typed group had a higher standard deviation, meaning that the test scores are more spread out from the mean, while the test scores of the control group are closer around the mean. A one-tailed, uncorrelated, equal sample t-test was used to test the following null hypothesis at the 0.05 level of significance: the mean scores of the typed group are not significantly different than the mean scores of the control (handwritten). For the typed group, $t(15) = 2.91386$, $p = 0.003343$. For this t-test, the t-value was greater than the p-value, resulting in significance of data. The null hypothesis was rejected, while the alternative hypothesis – the mean scores of the typed group are significantly different than the mean scores of the control (handwritten) – was not rejected. The data supported the hypothesis that academic performance will be higher for note-taking that was handwritten on paper than for note-taking that was typed, since the mean scores of the handwritten group are significantly higher than the mean scores of the typed group.

Conclusion

The purpose of this experiment is to answer the following question: Which method of note-taking is more beneficial for learning: paper-based or online? This experiment examines a traditional method (handwritten) compared to a more recent, technological method (typed). The scientific hypothesis is that if note-taking was handwritten on paper, then academic performance will be higher compared to notes that are typed on an electronic device. This experiment was conducted through the use of 2 surveys that gathered participant data. The first survey involved 101 participant responses about preferred note-taking methods, while the second survey was an assessment given to 32 participants who were assigned a specific method and were prompted to take notes on a Morse Code video. This experiment's findings are best used to provide an understanding of note-taking methods that result in the highest academic performance.

Two questions were analyzed from the initial survey. The first question asks about the method that students apply most often. Roughly 72.3% or 73 of the students used the handwritten method compared to the 2% or 2 of the students that used the typing method. Moreover, 25.7% or 26 of the students used both methods. The second question asks about the method that each student preferred. The results are as follows: 71.3% or 72 of the students preferred to take handwritten notes, 24.6% or 25 of the students preferred to take notes by typing, and 4.1% or 4 of the students had no preference. On both questions, the handwritten method was the main choice. Although this initial survey is a minor component of the note-taking experiment, it is an indicator that students prefer and use the handwritten method more often when taking notes.

A statistical analysis was conducted for the mean scores from the assessment (out of 10 total points) in the second survey. The second survey had 16 participants for each method. The

control group (handwritten method) had an average score of 7.5625, which was higher than the independent variable group (typed method), which had a mean score of 5.6875. The mean score of the handwritten method was significantly higher than the mean score of the typed method. A one-tailed, uncorrelated, equal sample t-test was used to test the following null hypothesis at the 0.05 level of significance: the mean scores of the typed group are not significantly different than the mean scores of the control (handwritten). For the typed group, $t(15) = 2.91386$, $p = 0.003343$. For this t-test, the $p < 0.05$, resulting in significance of data. The null hypothesis was rejected, while the alternative hypothesis – the mean scores of the typed group are significantly different than the mean scores of the control (handwritten) – was not rejected. Additionally, the standard deviation of the typed group was roughly 1.99, while the standard deviation of the control group was roughly 1.498. The typed group had a higher standard deviation, meaning that the test scores are more spread out from the mean, while the test scores of the control group are closer around the mean. The data supported the hypothesis that academic performance will be higher for note-taking that was handwritten on paper than for note-taking that was typed, since the mean scores of the handwritten group are significantly higher than the mean scores of the typed group.

Possible areas of improvement could include conducting the assessment in-person because more confounding variables could be controlled, and the data would be more reliable as all participants would be under the same testing conditions. In addition, there should be equal participant representation in the assessment from grades 9-12 since different ages have varying degrees of academic levels depending on the individual and the education curriculum. Time restrictions (ex: 10 minutes studying, 10 minutes to complete the test) should have been placed on the assessments to accurately compare the assessment scores between both methods. For the

initial survey, instead of general responses such as “always, sometimes, often,” a number scale should have been implemented because it is more specific and comparable.

Based on these findings, further experimentation on note-taking methods should conducted on more components of learning, since one method could be more beneficial for certain activities than others. For example, in a research study called “A Comparative Study of Handwriting and Computer Typing in Note-taking by University Students,” a sample consisting of 251 college students were divided into groups based on their preferences. The experiment consisted of more than one task of note-taking, including verbal, repetitive, and memorizing activities (Aragón-Mendizábal et al., 2016). The results of the experiment varied, since both methods had advantages and disadvantages in certain tasks. Moreover, further experimentation should also consider and assign participants to a specific method based on their own resource availability since that influences note-taking preferences and optimal performance. In a research study called “Information Comprehension: Handwritten vs. Typed Notes,” a group of 72 college students participated in an experiment that compared written and typed note-taking methods (Duran & Frederick, 2013). These students were equally assigned to a method based on their resource availability. The students were informed to take notes, watch a documentary, and complete a comprehension test. The results of the test were statistically significant as students who took handwritten notes had higher scores on the comprehension test than students in the typed notes group.

In conclusion, note-taking is an essential part of education regardless of which methods are used as 99% of college students take notes (Banke, 2016). Students also take notes for a variety of reasons, including to be actively involved in class, document knowledge learned in lectures, and study for exams (Dartmouth, n.d.-b). However, as the hypothesis – handwritten

notes lead to higher academic performance than typed notes – was supported by this experiment, there are several underlying logical and neurological reasons. When taking handwritten notes, the brain is actively processing and encoding information into memory through neural synapses and networks that communicate with each other to transfer the information into long-term memory (Arnold, 2022). Taking handwritten notes enables the person to arrange and emphasize particular information while they are attentive and focused on the material being provided (University of North Carolina, 2018). Students who take notes by hand must actively summarize the material they are taught before encoding it in their hippocampus. The act of writing contributes to priming, or associations of knowledge about "where" and "what." The temporal lobe's hippocampus, where learning and memory retention take place, can then be used to recall information (Ibáñez, 2021). In a behavioral neuroscience study by scientists at Princeton University and the University of California in 2014, students who took notes by hand performed better on conceptual problems than those who take their notes on digital devices (Mueller & Oppenheimer, 2014). The study suggested that handwritten notes ensure more natural coding as an explanation for these results. The use of electronic devices, on the other hand, encourages the students to write passively (recording all of the information). Overall, the benefits of handwritten notes include higher memory retention, natural encoding, and comprehension levels compared to typed notes, which are all factors that are crucial to note-taking.

Appendix

Survey Questions

Do you take notes for your classes? *

- Always
- Most of the time
- Sometimes
- Never

If you take notes, what method do you use most often? *

- Handwritten (paper)
- Typing (laptop, computer, etc.)
- Both

Which method of note taking do you prefer? *

- Handwritten (paper)
- Typing (laptop, computer, etc.)
- No preference

Why do you prefer using the selected method above? *

Long answer text

Do you like taking notes? *

- Yes
- No
- Sometimes

Do notes help you study? Yes or no? Explain. *

Long answer text

Do notes improve your assessment scores? *

- Yes , they usually do
- No, they usually don't
- Depends/it varies

Section 3 of 3

Watch this video only ONCE and take notes using your assigned method:

https://youtu.be/D8tPkb98Fkk

1) What does Morse Code consist of? *

- Dots and Dashes
- Dippin' Dots
- Commas and Semicolons
- Colons and exclamation marks

2) In the video, what personal matter motivated Samuel Morse to create Morse Code? *

- His cat died
- His had a child
- His child left him
- His wife died

3) As he mentions, what are the two methods? *

- "The Clean and Easy Way" and "The Champ's Way"
- "The Happy and Fast Way" and "The Slow Way"
- "The Quick and Dirty Way" and "The Masterful Way"
- "The Loser Way" and the "The Hard Way"

4) If you are going to the left side, what is the 1st symbol for those letters? *

- Dot
- Dash
- Period
- Comma

5) What is this letter? *

. . .

- V
- Q
- T
- S

6) What is this letter? *

- - .

- M
- O
- U
- E

7) What is this letter? *

. . . .

- T
- A
- D
- H

8) What is this letter? *

- . . -

- E
- F
- X
- Q

9) Slashes indicate a separation between letters. What is this word? *

- . . . / . - / -

- BAT
- CAT
- DAD
- MAD

10) Slashes indicate a separation between letters. What is this word? *

. . . . / . / . - . . / . - . . / - - -

- AMAZE
- FIGHT
- HELLO
- MIGHT

Raw Data

https://docs.google.com/spreadsheets/d/1uJLjHnaykGUi90_MJdCj713-0vsi944y4tIHJ_go21s/edit?usp=sharing

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