May 2022

The Effect of Note Taking on the Recall of Information

Emily Lichty  
*Dominican University of California*

https://doi.org/10.33015/dominican.edu/2022.EDU.10

IRB Number: 10997

---

**Survey: Let us know how this paper benefits you.**

**Recommended Citation**

https://doi.org/10.33015/dominican.edu/2022.EDU.10

This Master's Thesis is brought to you for free and open access by the Liberal Arts and Education | Graduate Student Scholarship at Dominican Scholar. It has been accepted for inclusion in Master of Science in Education | Master's Theses by an authorized administrator of Dominican Scholar. For more information, please contact michael.pujals@dominican.edu.
This thesis, written under the direction of the candidate's thesis advisor and approved by the program chair, has been presented to and accepted by the Department of Education in partial fulfillment of the requirements for the degree of Master of Science in Education.

Emily Lichty
Candidate

Jennifer Lucko, PhD
Program Chair

Katherine Lewis, PhD
First Reader

Elizabeth Truesdell, EdD
Second Reader
The Effect of Note Taking on the Recall of Information

By

Emily Lichty

A culminating thesis submitted to the faculty of Dominican University of California in partial fulfillment of the requirements for the degree of Master of Science in Education

Dominican University of California

San Rafael, CA

May 2022
Abstract

A large body of research shows that note taking style can influence how much information we remember, as well as whether notes should be taken on paper or a computer (Igo & Kiewra, 2007; Kobayashi, 2005; Mueller & Oppenheimer, 2014; Urry et al., 2021). Little research, however, investigates what students think about the note taking process. Therefore, the purpose of the study was to determine (1) students’ perception of the note taking process, (2) whether the explicit teaching of a note taking strategy improved students’ recall scores on learned information, and (3) whether physical note taking was more beneficial for student recall than digital note taking. The mixed methods study was conducted at the high school level, looking specifically at 10th graders. Nineteen secondary students participated in the research, completing a survey on their perceptions of note taking. Additionally, the participants learned vocabulary words in class and took notes in a way that was normal for them. After taking notes, the participants took a recall test on the vocabulary words. One week later, the same process was completed, however this time, students were taught a note taking strategy that emphasized paraphrasing. Participants took notes on the vocabulary words using the new note taking strategy and then took a recall test on the new set of words. The results were compared between the two conditions. When students were taught a note taking strategy, recall scores on a five question quiz increased. Further, students who took notes on paper tended to have better quiz scores than their digital note taking peers. Additionally, results of the student perspective survey indicated that students have been taught a note taking strategy, but no longer use it. Similarly, students revealed that they typically took notes by writing down a word-for-word definition of a new term. The results of the study emphasize the importance of teaching students note taking skills that promote encoding.
Acknowledgements

In reflecting upon the completion of this thesis, there are many people that deserve a special thanks. The first person that comes to mind is my Papa. All throughout college, he urged me to get a graduate degree, so I feel like I would not be here without him. I would also like to thank my parents for supporting my journey at Dominican University of California. Their financial and emotional support was imperative to my success both in this program and the teaching credential program. Finally, this acknowledgment would feel incomplete without thanking my classmates. Our weekly conversations (and rants) made the program more enjoyable. I always looked forward to class because it meant seeing close friends. I would not be here without all your support!

In looking at the thesis itself, I must extend my thanks to my 5th period students. Their participation in the study not only led to the completion of my graduate degree, but it also taught me valuable lessons that will impact the rest of my teaching career. The knowledge that I have gained in this experience will benefit future classes for years to come.

Finally, I would like to thank Katie Lewis and Elizabeth Truesdell for their feedback and support throughout this process. You two are the best! Also, the formatting of this document would be a complete mess without the help of Michael Pujals. I am so appreciative of your help!
Table of Contents

Abstract ........................................................................................................................................ iii
Acknowledgements .................................................................................................................... iv
List of Tables ................................................................................................................................ vii
Chapter 1: Introduction ................................................................................................................ 1
  Statement of Purpose .................................................................................................................. 1
  Overview of the Research Design .............................................................................................. 3
  Significance of the Research Findings ......................................................................................... 4
Chapter 2: Literature Review ........................................................................................................ 7
  History of Note Taking Research ................................................................................................ 9
    The Relationship between Note Taking and Encoding .............................................................. 9
      Encoding Hypothesis ............................................................................................................... 10
      Generative Hypothesis ........................................................................................................... 10
    The Relationship between Note Taking and Recall ................................................................. 11
  Effective Note Taking Strategies ............................................................................................... 12
    Paraphrasing ............................................................................................................................. 12
    Review of Notes ....................................................................................................................... 12
    Recording Relevant Information ............................................................................................... 13
  The Great Debate: Physical or Digital Note Taking? ................................................................. 13
  The Benefits of Laptop Note Taking .......................................................................................... 14
  The Downsides of Laptop Note Taking ....................................................................................... 16
    Copying and Pasting .................................................................................................................. 16
    Distractions and Multitasking ................................................................................................... 16
  The Benefits of Physical Note Taking ......................................................................................... 17
  Student Voice ............................................................................................................................. 18
  Conclusion .................................................................................................................................. 19
Chapter 3: Methods ....................................................................................................................... 21
  Research Questions .................................................................................................................... 21
  Description and Rationale for Research Approach ................................................................. 21
  Research Design ....................................................................................................................... 22
    Research Site and Entry into the Field ...................................................................................... 22
List of Tables

Table 1 Recall Scores: Class Averages................................................................. 35
Table 2 Recall Scores: Physical Note Takers ......................................................... 37
Table 3 Recall Scores: Digital Note Takers............................................................ 37
Chapter 1: Introduction

Note taking is universal. From classrooms to board meetings, people summarize information by taking notes. Researchers describe note taking as the act of making “written transcriptions of the material presented” (Di Vesta & Gray, 1972, p. 8). While the act of note taking is universal, the way we take notes is individualistic. Some take notes by making a bulleted list, while others create concept maps to visualize information. In some instances, the uniqueness of note taking can be beneficial, however, it can prevent learning from taking place if notes are not taken in an effective manner.

Statement of Purpose

The history of note taking dates back to the early 1900s, with the work of Kitson (1916). In this study, it was concluded that while note taking is an important skill, students do not always realize that it is a skill. In the next decade, researchers determined that students focus better when they take notes, which has the potential to increase test scores (Crawford, 1925b; Crawley, 1936). Since then, research on note taking has focused on why it increases test performance, which leads to a discussion of encoding.

Haynes and Williams (2015) explain that encoding occurs when we put information into our own words. Researchers have investigated a phenomenon known as the encoding hypothesis, which questions whether the process of taking notes influences the encoding of information (Kobayashi, 2005). This research has shed light on effective note taking techniques, such as summarizing, paraphrasing, or identifying the main idea. When students do these things, they encode more information from a text (Kobayashi, 2005). Similarly, when students are restricted in how much they can write in their notes, they become more evaluative and therefore remember
more information from the text (Igo & Kiewra, 2007). These findings are significant because they highlight how students can improve their learning.

While research suggests that students should be implementing effective note taking strategies to improve their learning, it is unclear whether students actually do. This concept identifies a gap in the literature and one of the purposes of the study. In regard to the gap in the literature, there is little research investigating how students feel about note taking. For instance, *how do students take notes? How were they taught to take notes? Do they review their notes?* These questions are significant, as they seek to reveal students’ thoughts regarding note taking. The purpose of the study, therefore, was to determine students’ perceptions of note taking.

Furthermore, the study also sought to determine whether the explicit teaching of a note taking strategy (paraphrasing) improved students’ memory of learned information. Additionally, the final purpose of the study was to determine whether students benefited from taking notes on paper or on their computer. With the educational system implementing more technology in the classroom, it is important to determine how it affects student learning. As we consider these purposes, it becomes apparent that note taking not only has the potential to affect student learning, but it also may be an equity issue.

If one method of note taking promotes student learning better than another, some students may be in an advantageous position. Schools and districts should be aware of the discrepancies between note taking styles so that they can give all students the opportunity to succeed. In addition, if the research determines that taking notes on a computer is more beneficial for students’ recall, it is possible that some students will have limited access to a computer. Therefore, the results of this study become significant not only in the sense that they will indicate
which note taking strategy is more effective, but also in their ability to shed light on how to create equal opportunity for students’ success.

**Overview of the Research Design**

The purpose of the study was to determine (1) students’ perception of the note taking process, (2) whether the explicit teaching of a note taking strategy improved students’ recall scores on learned information, and (3) whether physical note taking was more beneficial for student recall than digital note taking.

Research was conducted at a high school in Northern California. Nineteen individuals participated in the study, all of whom were enrolled in the researcher’s sophomore English class. The pool of student participants was made up of varying ethnicities, genders, and socioeconomic statuses, and academic levels. Secondary students were a necessary demographic to fill the gap in the literature (see Chapter 2: Literature Review). In order to understand the complexities of note taking, a mixed methods approach was necessary (see Chapter 3: Methods).

To analyze students’ perceptions of note taking, a qualitative design was utilized. Student participants completed a Google Form indicating their experiences and habits surrounding note taking. For example, the survey asked students how they had been taught to take notes and whether they still used that note taking method. Similarly, the survey inquired about student’s current note taking process and whether they reviewed their notes after class. Results from the survey were coded by the researcher to understand themes in the responses.

A quantitative design was utilized to assess whether the explicit teaching of a note taking strategy influenced the recall of information. Likewise, a quantitative approach was necessary to determine whether physical or digital note taking was more impactful on student learning. To understand these questions, student participants took notes on five new vocabulary words using
the medium (notes taken on paper versus a computer) and style (bullet points, concept maps, etc.) that they normally would use. The goal with this was to understand how beneficial students’ note taking habits were. After taking these notes, student participants were given a recall test one hour later. Then, two days later, they were given another recall test without any warning. The purpose of this was to understand how many of the words students remembered, both in the short and long term.

One week later, student participants were taught to paraphrase their notes. The process was then repeated from the week before. Students took notes on five new vocabulary words by paraphrasing the definitions. They still took notes using the medium they normally would. Then, they were given a recall test one hour after learning the words. Similarly, they were given another recall test two days later. The recall test data was then compared between the two conditions (taking notes with and without a note taking strategy).

Significance of the Research Findings

To determine students’ perceptions on note taking, participants completed a Google Form. In their responses, student participants indicated that they had been taught a note taking strategy in their history as a student; the majority of students were taught Cornell notes. Interestingly, students revealed that they no longer used the strategy they had been taught, which brings us back to the questions, how do students take notes? In answering this question, most student participants explained that they take notes by making a bullet pointed list. In this list, they write down the definition of the term they are being taught. Other students explained that they come up with examples, try to write the definition in as few words as possible, or use symbols to write the definition. The responses revealed inconsistencies in the ways that students
take notes. Finally, when asked how often they review their notes, most students divulged only reviewing notes before a test.

To determine whether the explicit teaching of a note taking strategy improved students’ recall, student participants took recall tests on new vocabulary words. In comparing the recall tests between the two conditions, it became evident that students benefited from learning how to paraphrase information; average recall scores were higher for the entire class after students paraphrased the vocabulary definitions. In looking at the differences between physical (notes taken on paper) and digital (notes taken on a computer) note takers, physical note takers performed better on the recall tests in most conditions.

These findings add to the literature by confirming the impact of effective note taking strategies on the recall of learned information. While this study focused on paraphrasing, the idea is that students should be taking notes in a way that promotes encoding. Similarly, the findings support the view that taking notes on paper is more beneficial for recall than taking notes on a computer. Finally, the research fills a gap in the literature by including students’ voices in the discussion of note taking practices and preferences. Students, specifically secondary students, had not been given the opportunity to discuss their perceptions on the note taking process.

The current research presents two problems. Students take notes in a way that is not benefiting their learning. Therefore, students should be made aware of the research so that they can take the necessary steps to improve their practices. This process will need to involve teachers who believe that making small adjustments to students’ note taking styles will have a large impact on memory and learning. Additionally, the research presents an equity issue. If some students are not made aware of the research findings, the achievement gap that exists in most
high schools will not be narrowed. All students should be taught effective note taking strategies, especially since it is a universal practice in the classroom.
Chapter 2: Literature Review

Research shows that students remember more information and perform better on assessments when they take notes during class lessons (Di Vesta & Gray, 1972). Note taking, as a definition, is the act of making “written transcriptions of the material presented” (Di Vesta & Gray, 1972, p. 8). Sounds simple, right? Well, the answer may not be as simple as it seems. While most students take notes during class, there is usually very little uniformity regarding their note taking style. Are students creating bulleted lists, using Cornell notes, creating concept maps? It stands to reason that many students have individual note taking preferences. This is not even considering students’ use of technology in the classroom. Over the past decade, we have seen an increase in technology use around the globe. It is no surprise that this increase has reached the classroom. With the educational system using more and more technology, many students are opting to take notes on their laptops. The question then becomes, are students taking notes in a way that is beneficial toward their learning? Could they be taking notes in a way that increases how much they remember from each lesson? If we can improve students’ performance in the classroom just by changing their note taking style, why wouldn’t we do that?

As we consider these questions, it becomes apparent that note taking may be an equity issue. If one method of note taking is more effective than another, some students may have an advantage. Students need to be educated on the research so that they have an equal opportunity to succeed in the classroom. In addition, access to various note taking methods may be limited for some students, as well as their school districts. If the research determines that taking notes on a computer is more beneficial for students’ recall, there is no guarantee that all students will be able to bring a computer to school. Therefore, the results of this study become significant not
only in the sense that they will indicate which note taking strategy is more effective, but also in their ability to shed light on how to create equal opportunity for students’ success.

While research on note taking is not sparse, there is not much research examining the note taking styles of students in a high school classroom. Most of the research focuses on college and elementary age students. Similarly, there is a lack of research regarding students’ perceptions of note taking. Have students ever thought about how they take notes? Have they ever been taught to take notes? Why do they prefer to take notes physically or digitally?

Like much of the research in this area, the purpose of this study was to determine whether students benefit from learning how to take notes in a way that maximizes the encoding process. Along with this idea, the research also sought to investigate any recall differences when students take notes on a laptop versus on a physical piece of paper. This concept connects back to the equity issue discussed above. Along with investigating recall differences, this study aimed to shed light on how all students can be successful in the classroom. Finally, the research opened a dialogue with students about their views and perceptions of note taking.

The goal of this literature review is to examine a variety of note taking methods, while also determining the effectiveness of these methods as determined by their influence on encoding and recall. In the following sections, a brief history of note taking will be presented, followed by a discussion on how note taking relates to encoding and recall. This review will then shift its focus to which note taking strategies best influence student recall of information. Within this discussion is the debate as to whether physical or digital note taking is more beneficial for student learning. Lastly, this review will conclude with a student voice section as a way to address the gap in the literature.
History of Note Taking Research

The history of note taking research can be traced back to the early 1900s, with the work of Kitson (1916). Kitson (1916) discussed the importance of taking notes during a lecture. The author suggests that students do not realize the amount of skill that goes into taking notes. Further, taking notes increased students’ ability to study (Kitson, 1916). Almost a decade later, research determined that note taking improved test performance (Crawford, 1925b). Later research emphasized that taking notes was beneficial to the student because of its organized nature during a potentially unorganized lecture and the fact that it kept students focused during the lecture (Crawley, 1936). It stands to reason that if students are actively participating during a lesson, as Crawley (1936) determined, their test scores may improve (as Crawford (1925b) researched a decade before).

Since then, research in this field has determined why note taking leads to better test performance, specifically looking at how taking notes helps our brain encode new information, how the encoding process leads to better recall, what types of note taking strategies are most effective in aiding student learning, and whether physical or digital note taking is most effective for student learning. The following sections address these areas of research.

The Relationship between Note Taking and Encoding

Encoding occurs when we take information and put it into our own words (Haynes & Williams, 2015). Luo et al. (2018) emphasize the importance of writing down learned information, rather than just listening to it. According to the researchers, “hearing and writing lesson material is better than simply hearing it because additional writing leads to more distinctive encoding and better memory for the lesson material” (Luo et al., 2018, p. 948). Note taking is an effective strategy for students because it helps the brain encode learned information.
As seen in this research (Luo et al., 2018), notes do need to be written down to have an impact on the encoding process.

Di Vesta and Gray (1972) explain that notes are beneficial because they can serve as an external storage mechanism and an encoding mechanism. The external storage mechanism is the review of notes after they are taken, and the encoding mechanism is the transcription of ideas while listening to a lecture. The authors warn that notes taken only as an external storage function will not lend itself to efficient learning (Di Vesta & Gray, 1972). In other words, only reviewing notes will not help students remember information. Students should be reviewing notes that have been put into their own words.

**Encoding Hypothesis**

Researchers have investigated the encoding hypothesis, which questions whether the process of taking notes influences the encoding of information (Kobayashi, 2005). When students are told to make a summary, paraphrase information, or identify the main idea, they encode more information from a text (Kobayashi, 2005). Similarly, when students are restricted in how much they can write in their notes, they become more evaluative and therefore remember more information from the text (Igo & Kiewra, 2007). From this, we learn that students should be paraphrasing learned information, as well as shortening the length of their notes, to maximize the encoding process. Too often, students feel like more notes leads to more information learned. The reality, however, is that less notes are actually more beneficial because this requires the student to determine what is most important.

**Generative Hypothesis**

Researchers have also discovered the importance of connecting new information to previously learned knowledge. The generative hypothesis “posits that note takers better
assimilate lecture ideas with prior knowledge than do listeners because the note taking process encourages students to paraphrase, organize, and integrate new lesson material in line with related prior knowledge” (Luo, Kiewra, Flanigan, & Peteranetz, 2018, p. 948). Additionally, less generative notes (notes that are not summarized or paraphrased) are encoded less because the connection to the new material is weaker (Kobayashi, 2005). This research is significant because it continues to emphasize the importance of paraphrasing new information, while also adding a new element to the note taking process - connecting to prior knowledge.

The Relationship between Note Taking and Recall

Recall refers to our ability to retrieve or remember information that has been stored away for some period of time. Di Vesta and Gray (1972) studied the effects of note taking on the recall of information. The authors concluded that note taking, as well as immediate review of notes, increased students’ recall of main ideas in a lecture (Di Vesta & Gray, 1972). Dewey (2021) added to this idea by explaining that students who took more notes performed significantly better on a recall test. Further, Bui, Myerson, and Hale (2013) concluded that generative note taking, relating new information to previously learned information, leads to better memory and recall. Outside the world of education, Thorley (2016) determined that jurors recalled more information about a trial after taking notes.

These studies are significant since the act of recalling information is one that students are constantly asked to do in the educational setting. Students are better able to recall previously learned information when they take notes in a way that effectively encodes information. Thus, the connection between note taking and encoding is crucial when thinking about note taking strategies because it directly connects to students’ ability to remember information.
Effective Note Taking Strategies

Paraphrasing

As mentioned previously, there are a variety of note taking strategies that help students encode information. When learning new information, students should be paraphrasing or summarizing what they read or hear (Igo & Kiewra, 2007; Kobayashi, 2005). Writing verbatim notes does not allow the brain to deeply encode the information. Consequently, students will forget learned material rather quickly. In addition, rather than copying down all the presented information, it is better for students to write it in their own words, in a way that makes sense to the learner (Haynes & Williams, 2015). Like the last strategy, copying and pasting information leads to a shallower encoding process in the brain. Writing notes in a paraphrased way allows the learner to understand material in a way that makes sense to them. Further, connecting new information to previously learned material can help students remember what they learned (Kobayashi, 2005; Luo, Kiewra, Flanigan, & Peteranetz, 2018). We tend to remember new information when we synthesize it with knowledge that has already been deeply encoded in the mind.

Review of Notes

Research on note taking has revealed the importance of reviewing notes after a lecture. According to Luo, Kiewra, Flanigan, and Peteranetz (2018), note taking is positively correlated with achievement because of process and product. Process is the act of note taking and the product is the review of the notes. It appears that the combination of taking and reviewing notes has a positive effect on student achievement. Similarly, Kobayashi (2005) discussed that note taking is not as beneficial when the notes are not reviewed after the fact. This suggests that
without reviewing notes, students may not be fully benefiting from the notes they are taking during a lesson.

**Recording Relevant Information**

Haynes and Williams (2015) also investigated notetaking trends in regard to the total amount of words recorded, as well as the relevance of those words. Results indicated that taking notes during a lecture was beneficial to academic performance because students were able to record more relevant information. The researchers also noted that participants took notes on significantly less relevant information than what was available on the instructor’s PowerPoint slides. Based on this information, it stands to reason that students may not know how to pick out the most important information on a PowerPoint slide. Teaching students to paraphrase information can only go so far if they do not know what information is most important.

Historically, note taking strategies were only implemented on a piece of paper. Now, however, more and more students are taking notes on their laptops. Consequently, the discussion has shifted in a way that questions whether taking notes on a piece of paper is a “strategy.” The following section will dive deeper into this question.

**The Great Debate: Physical or Digital Note Taking?**

When Kitson (1916) first began researching note taking, he had no idea what the future of note taking would hold. At the time, the idea of digital note taking was not a reality; research only focused on the benefits of taking notes during a lecture. While the act of note taking has not changed over the years, the style has. The increase of technology in the classroom has led to a variety of note taking styles, both physical and digital. With approximately \( \frac{1}{3} \) of college students taking notes on a laptop, researchers began assessing which was better for memory and academic performance (Luo, Kiewra, Flanigan, & Peteranetz, 2018).
Aragón-Mendizábal, Delgado-Casas, Navarro-Guzmán, Menacho-Jiménez, and Romero-Oliva (2016) widely acknowledged the fact that modern day technology is replacing the hand-written element of note taking, which has spurred discussion and debate within this field of research. Fried (2008) adds that many professors have banned laptop use in the classroom altogether to combat this problem. In many cases, laptop banning has caused outrage among students, causing some professors to lift the ban (Fried, 2008). It stands to reason that many students feel strongly about their preferred method of note taking. With the introduction of technology in the classroom, as well as the debate it has caused, researchers are actively trying to determine which note taking style best supports student learning.

The Benefits of Laptop Note Taking

Research that supports the use of laptop note taking in the classroom cites the ability of laptops to engage and connect students (Finn & Inman, 2004; Hall & Elliott, 2003; Hyden, 2005; Lindorth & Bergquist, 2010; Weaver & Nilson, 2005). Much of the research supports the idea that laptops promote student interaction in the classroom (e.g., Hyden, 2005). This is especially true with the current climate of the COVID-19 pandemic. During the worst of the pandemic, technology was utilized as a way to engage students in learning. Laptop supporters also believe that digital note taking is effective because of the amount of words recorded during a lecture.

Luo, Kiewra, Flanigan, and Peteranetz, (2018) concluded that laptop note takers recorded more words as well as more verbatim notes. This may lead to more encoding, according to Bui, Myerson, and Hale (2013). They explain that writing more words during a lecture leads to more encoding of learned information. If number of words is linked with encoding, then laptops seem to be a great tool for students since many individuals can type faster than they write (Brown, 1988).
This finding is supported by Urry et al. (2021), who replicated one of the most well-known note taking studies (The pen is mightier than the keyboard: Advantages of longhand over laptop note taking). Their research contradicts the original study, which concluded that laptop note takers record more words in their notes and take notes in a more verbatim style than their counterparts. Research by Urry et al. (2021) echoed this finding. Their findings were different, however, in the conclusion that higher word count was associated with better quiz scores. The researchers did make the distinction that while higher word count led to heightened performance, verbatim notes did not. Bui, Myerson, and Hale (2013) propose an alternative view on the number of words recorded - the quality of one’s notes may be much more important than the quantity. This view is supported in the Urry et al. (2021) replication study. If this is the case, students may benefit from recording as many words possible during class, before paraphrasing the information into their own words. Taking verbatim notes with the goal of recording as many words as possible does not seem to be beneficial. These findings are significant because they pose a warning to students that more words is not necessarily better; those words need to be meaningful to the student.

Aragón-Mendizábal, Delgado-Casas, Navarro-Guzmán, Menacho-Jiménez, and Romero-Oliva (2016) found that digital note takers scored significantly higher on recognition tasks compared with physical note takers. This finding may connect to the idea that recording more words helps students remember more information. With this idea in mind, it is not unreasonable to assume that laptop note takers may have access to more concepts than physical note takers since they record more words. It stands to reason that these students may have performative success in certain types of assessments. While there is significant research on the benefits of
laptop note taking, most of the research discusses the detriments of digital note taking on student performance in the classroom.

**The Downsides of Laptop Note Taking**

*Copying and Pasting*

Some researchers are critical of digital note taking because of the copy/paste function on a laptop. Igo and Kiewra (2007) investigated the effects of copy/pasting notes during a class lecture. The researchers concluded that high-achieving students were less affected because they copy/pasted information in a more selective way (Igo & Kiewra, 2007). Other students, however, performed worse on assessments because they did not evaluate the information they were copying and pasting. While copying and pasting information is easier than typing it out, it should be used with caution.

*Distractions and Multitasking*

Another criticism of digital note taking comes from the distracting nature of laptops. Fried (2008) indicated that students admittedly spend time multitasking, rather than focusing solely on their notes. Consequently, students were less engaged during lectures, which resulted in lower test scores. In addition, Wammes et. al (2019) studied the increasingly distracted behaviors of digital note takers, concluding that students multitasked more as time elapsed in class. This demonstrates that laptops provide students with an easy outlet to distract themselves.

Not only has the research focused on the detriments of using laptops to take notes, it has also revealed how harmful a neighbor’s off-task activities can be. Hall, Lineweaver, Hogan, and O’Brien (2020) investigated whether an off-task neighbor could negatively impact other students’ retention of learned material. They concluded that “participants’ comprehension and retention of material covered while their laptop-using neighbor was on task was indeed
significantly better (over nine percentage points higher) than their comprehension and retention of material covered while their neighbor was off task” (p. 4). This finding is significant because it shows that laptops can be detrimental to one’s own learning, as well as a neighbor’s learning. Similarly, Aguilar-Roca, Williams, and O’Dowd (2012) sought to determine whether laptop use was harmful to surrounding students who were taking notes by hand. The idea behind this was that many students who take notes using their laptop also surf the web during class, which distracts surrounding students. The results indicated that laptop use did not impair the performance of physical note takers; however, the researchers did find that laptop note takers performed significantly worse on assessments when compared to physical note takers. Research in this area has not only revealed the harmful effects of digital note taking, but it has also highlighted the benefits of taking notes by hand.

The Benefits of Physical Note Taking

Mueller and Oppenheimer (2014) found that laptop note takers took notes verbatim, whereas physical note takers summarized important information. Consequently, students who took notes on their computer had shallower encoding than those who took notes by hand. The researchers even found that students who reviewed notes a week later performed worse on tests of factual and conceptual material, which shows the benefits of taking notes by hand. This research supports what we know about encoding because it highlights the importance of summarizing and paraphrasing new information.

Similarly, Luo, Kiewra, Flanigan, and Peteranetz, (2018) found that laptop note takers recorded more notes, as well as more verbatim notes. On the other hand, physical note takers wrote fewer words and used more images and signals in their notes. These note takers also paraphrased information more than digital note takers. When given the opportunity to review
their notes, physical note takers performed better on assessments. However, when there was not an opportunity to review, digital note takers performed better on assessments. The results of this study highlight not only the importance of paraphrasing notes, but also the opportunity to review notes. Finally, Aragón-Mendizábal, Delgado-Casas, Navarro-Guzmán, Menacho-Jiménez, and Romero-Oliva (2016) found that digital note-takers scored significantly higher on recognition tasks and physical note-takers scored significantly higher in memory tasks. This suggests that physical note takers remember more information than those who take notes on a computer. The results also indicate that there may be a time and a place for each note taking style, depending on the type of assessment.

**Student Voice**

The need for student perspective is not only a gap in the literature, but also an equity issue. According to Mitra (2000), student voice initiatives give students a voice by allowing them to weigh in on school problems, as well as potential solutions to those problems. Students are often neglected when it comes to problem solving or researching school issues. With an additional voice, schools can reevaluate the decisions being made to address these problems. Similarly, students may offer a perspective that adults had not considered. Mitra (2000) describes surveys and interviews as a helpful, yet manageable, way for adults to connect with students about their perceptions on the topic at hand. Adults are not the only ones who benefit from student voice techniques – students may feel an increased sense of ownership in themselves and their voice. Johnson (1991) describes this in his research, explaining that students feel more motivated and engaged because of their visibility within the school culture.

Finn and Inman (2004) created an informational technology initiative and conducted research on students’ perceptions of this initiative. Participants showcased positive perceptions
of the initiative to bring technology into the classroom. Not only did students have positive perceptions of technology in the classroom, but they also acknowledged its importance. Dunkel and Davy (1989) sought to determine the opinions of both American and international college students regarding the importance of note taking. Their results concluded that students believe note taking is an important part of the educational process. With the amount that students are required or expected to take notes in school, this finding is important. The question now becomes, while students recognize the importance of taking notes in the educational setting, are they implementing note taking strategies that improve their memory of learned information?

Conclusion

There has been a considerable amount of research on note taking in the classroom. Based on the literature, taking notes during class is more beneficial than not taking notes. From there, the evidence suggests that implementing a note taking strategy (paraphrasing new information, connecting new information to prior knowledge, reviewing notes after each lesson, determining what information on a slide is most important, etc.) can aid in students’ ability to remember and recall information. In addition, research into note taking has shed light on how students can best maximize their time during a lesson. These findings have improved students’ grades on assessments, as well as their memory of lecture topics.

While current literature has addressed a variety of note taking strategies, as well as how those strategies are encoded in the brain, there is a gap in the literature surrounding the note taking of high school students. Most of the research in this field highlights college and elementary age students. Similarly, there is little research that investigates secondary students’ perceptions on note taking. Therefore, one of the purposes of this study was to close the gap by researching note taking strategies in the high school setting. By talking directly with high school
students, the research was focused on adding a critical voice to the ever-evolving realm of note taking. In addition, this study sought to understand whether students’ recall abilities improve after being taught an effective note taking strategy. Within that analysis, the research also determined whether physical or digital note taking is more beneficial with regards to students’ recall scores. Finally, the research sought to address an equity issue within the field of note taking by shedding light on how all students can be successful in the classroom.
Chapter 3: Methods

There are numerous studies investigating how note taking influences recall and memory (i.e. Haynes & Williams, 2015; Igo & Kiewra, 2007; Kobayashi, 2005); most of this research occurs at the university level. Little research, however, focuses on how high school students respond to a note taking strategy. In addition, there is little research on how high school students feel about note taking, and whether they use a note taking strategy during class lessons. Therefore, the purpose of this study was to investigate how a note taking strategy influenced recall in a high school classroom. Additionally, the study sought to understand students’ perceptions on note taking by using student voice methodology (Mitra, 2000). Finally, the study was interested in determining whether there is a difference in recall in students who take notes on a Chromebook or on paper.

Research Questions

1. How does explicit teaching of a note taking strategy impact recall with secondary students in a 10th grade English class?

2. How do recall scores differ when secondary students in a 10th grade English class take notes on a Chromebook compared with a piece of paper?

3. What are secondary students’ perceptions of note taking?

Description and Rationale for Research Approach

Two worldviews are presented in my research: postpositivism and constructivism. Postpositivism holds a “deterministic philosophy in which causes (probably) determine effects or outcomes” (Creswell & Creswell, 2018, p. 6). This type of research is traditional in the sense that it closely follows the scientific method by beginning with a theory, collecting data, and conducting additional tests (Creswell & Creswell, 2018). The current study supported a
postpositivist worldview because of its emphasis on collecting and analyzing numerical data on recall scores. On the other hand, constructivist research relies “as much as possible on the participants’ views of the situation being studied” (Creswell & Creswell, 2018, p. 8). Similarly, it seeks to understand the world that participants live in by asking open-ended questions (Creswell, 2014). Further, this study supported a constructivist worldview because I sought to understand how students feel about their note taking style, as well as what they have learned about taking notes. Seidman (2013) explains the importance of interviewing participants by emphasizing that “at the root of in-depth interviewing is an interest in understanding the lived experience of other people and the meaning they make of that experience” (p. 9). In the current study, students were given open-ended survey questions to understand their experiences taking notes and learning how to take notes, thus supporting the research of Creswell and Creswell (2018), and Seidman (2013).

The purpose of the study was to address a gap in the literature by collecting survey data on students’ preferred method of note taking. Additionally, the research sought to identify whether learning how to paraphrase notes influenced the recall of learned material. In analyzing this data, the research also sought to determine whether there was a difference in recall between students who took notes on a computer versus students who took notes by hand. For these reasons, a mixed methods approach was most suitable. A quantitative approach was necessary to analyze the recall scores of participants, whereas a qualitative approach was required to code the student voice responses.

Research Design

Research Site and Entry into the Field

Students at a high school in Northern California were recruited to be in the study. The high
school serves 1,100 students ranging in grades from grade 9 to 12. 53% of students are male and 47% are female. 57% of students are White, 29% of students are Hispanic, 7% are Asian, and 6% are two or more races. This school was purposefully selected because the researcher is a teacher who has students in both freshman and sophomore English classes. To maintain confidentiality all data was kept in a password protected computer. In addition, data was deleted one year after the completion of the study.

**Participants and Sampling Procedures**

Nineteen 10th grade students at a Northern California High School were recruited for participation in the study. Their ages ranged from fourteen to sixteen years old, meaning that they were all minors. This sample of students included multiple genders and ethnicities, including White, Asian, African American, Latino, and mixed-race participants. In addition, two student participants were redesignated English learners. Student participants were solicited through direct invitation after a brief presentation about the study’s purpose and methodology during regular class time. Students then filled out a consent form, as well as a proxy consent form that was signed by their parents. As such, the study relied on a convenience population sample based on the number of students who chose to volunteer to participate and received consent from their parents.

These students were purposefully selected, as I taught their English class and had observed how they take notes during a lesson. The purpose of recruiting students was to understand note taking in a high school classroom, a concept that has little research dedicated to it. This type of sample was desirable and purposefully chosen given that all the participants were students who had experience taking notes and needing to remember information from those
notes. This sample allowed me to “[best] understand the problem and the research question[s]” (Creswell & Creswell, 2018, p. 185).

At school, students in my English class were verbally asked to participate in a survey and two recall tests after watching an introductory presentation. Students were reassured that participation in the study would not affect their grade in the class. Interested students took home a proxy consent form to be signed by a parent/guardian. The proxy consent form outlined the study’s purpose, provided methodology and risk information, and detailed how data would be collected and protected (see Appendix D).

**Methods**

Prior to the study, I received permission to recruit from the school site, and students provided verbal consent and then written consent (with proxy consent from students’ guardians). On the first day of the study, I reminded students of the purpose of the research and emphasized again that participation was voluntary and would not affect their grade in the class. Afterwards, I instructed participants to take a note taking survey on their school-provided Chromebooks (see Appendix A). The format of the survey was a mixture of closed-ended and open-ended questions. Questions were designed to assess their knowledge of note taking strategies, whether they implemented a note taking strategy, how they preferred to take notes (on a computer or on a piece of paper), how often they took notes, and whether they reviewed their notes after a lesson. Student participants were given ten minutes to complete the survey.

The next section of the research took two weeks to complete. During the first week, participants learned five new vocabulary words and took notes however they typically would in class. This entailed both the note taking style and the medium (taking notes on a piece of paper or a computer). It is important to note that four students took notes on their computer, while
fifteen students took notes on a piece of paper. After taking notes on the five words, we continued with normal class proceedings. One hour later, students were given a recall test on the five vocabulary words. The test was five questions long - one question for each vocabulary word (see Appendix B). On the test, student participants were asked to write the definition of the words in a free response format. That way, students had to remember the word to get the question right. Two days later, student participants were given the same recall test to assess their long term memory (see Appendix B). In both cases, students did not expect to be tested on the words.

At the beginning of the next week, I taught the participants how to take notes by paraphrasing new information into their own words. I selected this style because I wanted them to be able to use it in any structure they already had in place. After I explained how they were going to take notes for the rest of the week, we practiced with a vocabulary word. I instructed them to read the definition of the word without writing anything down. They were not allowed to touch their paper while the definition was still on the screen. Once they had read the definition a few times, I put a blank slide on the screen and instructed them to write down the definition in their own words. After about one minute, the class discussed their unique definitions.

The next day, the class took notes on five new vocabulary words using the paraphrasing strategy I taught them the day before. Although students could not choose how they took notes, they were still able to take notes on their preferred medium (paper versus computer). After taking notes on the five words, we continued with normal class proceedings. An hour later, students took a recall test on the five words. The recall test was set up in the same open-ended format as before (see Appendix B). Participants took the second test two days
after learning the words.

Data Analysis

I collected data through two recall tests and a student survey. For the recall tests, I scanned the data to get a preliminary exploratory analysis of the recall scores. Exploring the data in this way helped to get an overall sense of how students reacted to the note taking strategy (Creswell, 2005). From there, I averaged and compared recall scores from the first and second test. This data can be found in Chapter 4: Research Findings (see Tables 1, 2, and 3). Because this study was not purely quantitative, averaging the scores was the most realistic and manageable method as a teacher.

Regarding the student survey, participants completed the survey on a Google Form. Before I sent out the survey, I wrote analytic memos to “facilitate [analytic] thinking [about data], stimulating analytic insights” (Maxwell, 2013, p. 105). From there, I coded the data to discover themes within students’ responses. Maxwell (2013) explains that coding rearranges the data “into categories that facilitate comparison between things in the same category and that aid in the development of theoretical concepts” (p. 107). Maxwell (2013) also discusses the importance of creating expected and unexpected codes before analyzing the data. Further, I expected students to reveal that they had been taught one note taking method (likely Cornell Notes) in their previous schooling experience, however I did not think they would continue to use that note taking method. I did not expect students to reveal that they continue to use the note taking method they had been taught in school. This anticipation comes from my experience looking at students’ notes in the classroom. In addition, I expected students to admit that they preferred taking notes on a computer because they could easily find their notes at a later time. In my experience as a teacher, students complain about taking notes on paper because they lose the
notes after class. I did not expect students to prefer taking notes on paper for this reason. Finally, I expected students to explain that they only reviewed their notes for higher level classes, such as Advanced Placement classes, or before a test. On the other hand, I did not expect students to regularly review notes taken in class, nor did I expect them to do this for all their classes.

After all students completed the survey, I analyzed the data and compared it to my expected and unexpected codes. For the student perception survey, I coded the data to gather common themes and repeated ideas. In doing this, I read through each response twice, taking notes on key words or phrases that I saw. Once I read through all individual responses, I reviewed my notes to see which words and phrases were repeated for the whole group. Searching for repeated ideas and themes made data analysis much easier.

For the recall data, I conducted basic quantitative analysis by collecting and analyzing the recall scores for both assessments, looking for averages and trends. I then presented the average scores in a table that can be found in Chapter 4: Research Findings (see Table 1). From there, I separated the data based on participants who took notes on the computer or on paper. To better see trends in the data, I created a table with the recall scores based on different note taking mediums (taking notes on a computer versus on paper). From there, I compared the averages to determine which note taking medium was more beneficial for student recall. These results can be found in Chapter 4: Research Findings (see Tables 2 and 3).

Validity

As the teacher of the participants, I may have influenced data collection because I had a personal investment in wanting the note taking strategy to positively affect my students’ academic performance (researcher bias). Reactivity is also important to consider, because my role as their teacher influenced the environment that the data was collected in. My role as a
teacher may have impacted the participants’ behavior during the study. Therefore, I implemented several strategies to address these validity threats.

To start, I designed my study so that it achieved triangulation. Having two recall tests and a student survey created three data points to assess. This increased validity in the research because there were more sources of data to analyze (Maxwell, 2013). In addition, I searched for discrepant evidence and negative cases while analyzing the student survey data. Acknowledging and analyzing negative cases helped ensure that my researcher bias was addressed throughout the data analysis period (Maxwell, 2013). Furthermore, my relationships with my students may have actually improved my research findings. According to Creswell and Creswell (2018), participant/researcher relationships can lead to more accurate findings. In my classroom, I try to create an environment where students see themselves as equals, both within themselves and with me. Our relationship may have led them to produce more in-depth responses on the survey. Similarly, because our relationship is strong, students may not have felt pressure to produce the answer I was looking for, resulting in more accurate responses.
Chapter 4: Findings

A large body of research shows that note taking style can influence how much information we remember (Igo & Kiewra, 2007; Kobayashi, 2005). Similarly, researchers have investigated whether notes should be taken on paper or a computer, linking note taking medium to recall of learned information (Mueller & Oppenheimer, 2014; Urry et al., 2021). Little research, however, investigates how students perceive the note taking process. Student voice initiatives give students a platform to express opinions on educational issues (Mitra, 2000). In the field of note taking research, student voice studies are hard to come by. This further emphasizes the importance, and necessity, of involving students in the conversation of note taking practices. Therefore, the purpose of the study was to determine (1) the student perspective on the note taking process, (2) whether the explicit teaching of a note taking strategy improved students’ recall scores on learned information, and (3) whether physical note taking was more beneficial for student recall than digital note taking. Upon researching note taking, two major themes became evident: “Student Perceptions of Note Taking” and “Note Taking and Its Effect on the Recall of Information.”

The first section of this chapter addresses the research question, what are secondary students’ perceptions of note taking? Three sub-themes are presented in the section “Student Perceptions of Note Taking.” The first sub-theme details student participants’ responses indicating whether they were previously taught to take notes. The second sub-theme discusses participant responses revealing how they currently take notes. Finally, the third sub-theme discusses what motivates students to review their notes.

The second section of this chapter addresses the component of the research dedicated to understanding how note taking can influence students’ recall of learned information. This section
is called “Note Taking and Its Effect on the Recall of Information” and it answers the following research questions: *How does explicit teaching of a note taking strategy impact recall with secondary students in a 10th grade English class? How do recall scores differ when secondary students in a 10th grade English class take notes on a Chromebook compared with a piece of paper?* Three sub-themes are presented in this section. The first sub-theme details the class average of the recall scores when students took notes however they wanted to. On the other hand, the second sub-theme discusses the class average of the recall scores when students took notes using a note taking strategy. Results from these two themes showed that recall scores improved when students were taught a note taking strategy that emphasized paraphrasing. This result directly answers the research question because it explains that the explicit teaching of a note taking strategy improves recall. Finally, the third sub-theme compares the recall scores of participants who took notes by hand versus on a computer. The results from this section answer the research question, as they reveal that physical note takers performed better on most of the recall tests.

**Student Perceptions of Note Taking**

Nineteen secondary students completed a survey on note taking. All student participants were in the 10th grade, ranging in age from fourteen to sixteen. Results from the initial student survey about note taking preferences showed three major sub-themes related to responses. These are laid out in the following order: “Most Students Have Been Taught Cornell Notes,” “Note Taking Inconsistencies,” and “Upcoming Tests Motivate Students to Review their Notes.”

**Most Students Have Been Taught Cornell Notes**

When asked whether they had been taught to take notes throughout their educational history, most student participants explained that they had been taught to use Cornell notes.
Cornell notes ask the student to split the page into three sections (Pauk & Owens, 2010). The biggest section (on the right side of the paper) is dedicated to taking notes on the lesson. These notes may include facts and definitions. The smaller section (on the left side of the page) is used to write out questions about the notes. Finally, students write a summary of the lesson on the bottom of the page.

Interestingly, only two students were taught to paraphrase new information by putting it into their own words, writing as little as possible, or using symbols. Furthermore, most students did not continue to use the note-taking strategy they were taught in earlier grades. This finding is surprising and makes me wonder why students have abandoned their previously learned note-taking strategy. Perhaps the strategy was too cumbersome, or students did not see the benefit. Similarly, the pace of instruction may have been too fast for them to complete their Cornell notes. While most students reported commonly abandoning Cornell notes, they did not all choose a similar new note-taking strategy, leading to the second sub-theme: “Note Taking Inconsistencies.”

**Note Taking Inconsistencies**

Throughout the survey, student participants reported inconsistency in the way that they currently take notes, as well as when they decided to take notes. Regarding how they took notes, students expressed a lack of uniformity. Some students revealed that they took notes by writing the new vocabulary term and its definition. This is demonstrated in the following student response, “I will first write a title, then I will copy down the terms, and finally the definitions.” A few participants reported adding to this process by writing the term, its definition, and their own example. One participant recorded that they wrote the “what, why, and how” of the lesson (a strategy used by all teachers at my school site). Other participants explained that they wrote the
“important parts from the slideshow.” This response made me wonder how this participant determined what was most important. Are students able to process new information and determine its main ideas? Have they been taught this skill?

Students were also inconsistent in the frequency in which they took notes during class. While many participants described taking notes four to five times a week in all their classes, roughly one-fourth of the student participants revealed that they only took notes when the teacher told them to. Participants conveyed responses like this one: “I only take notes in classes when the teacher says to, so every day in most classes.” This participant’s response demonstrates that the teacher determined what material was important, connecting back to the question of whether students determine this importance themselves. If teachers are telling students what is important, are students then able to write down the most important information in a lesson? Is this a skill we need to be teaching our students? This sub-theme pointed to inconsistencies in how often students take notes, which lead to the next sub-theme: “Upcoming Tests Motivate Students to Review their Notes.”

**Upcoming Tests Motivate Students to Review their Notes**

A third sub-theme present in the research findings is that tests motivate students to take notes. In the survey, students were asked whether they reviewed their notes after a lesson, and while a few indicated that they either did or did not, half of participants divulged that they only reviewed their notes before an upcoming test. One participant explained, “if I have to study for a test and the notes help me then yes, I will review them.” Another asserted that they would review their notes “only if it's the night right before a big test I'm worried about.” This revelation reinforces a challenging dynamic in the world of education: how students are motivated. Most participants indicated that they were motivated by upcoming assessments when it came to taking
and reviewing notes. It stands to reason that those students are more motivated by the result of an upcoming exam, rather than mastering the information.

**Note Taking and Its Effect on the Recall of Information**

This section highlights how note taking affected student participants’ recall of new vocabulary words. It is separated into three sub-themes: “Recall Scores: Class Average with Student-Choice for Note Taking Method,” “Recall Scores: Class Average with Note Taking Intervention,” and “Comparing Recall Scores Across Note Taking Mediums.” The first sub-theme focuses on the recall scores of the class when everyone was allowed to take notes using their own preferred style. The average includes both digital and physical note takers, of which there were four and fifteen, respectively. The second sub-theme, on the other hand, discusses the recall scores of the class when a note taking strategy was modeled for participants. Finally, the third sub-theme compares recall data from physical and digital note takers.

**Recall Scores: Class Average with Student-Choice for Note Taking Method**

Nineteen secondary students (all in 10th grade) participated in this research. Fifteen students took notes by hand and four took notes on their computer. When student participants learned five new vocabulary words and took notes however they preferred, the class averaged a 2.58 out of 5 on a recall test (see Table 1). This test was taken one hour after learning the words. Students were not able to review the vocabulary words before the test. In fact, students were given a distractor activity, which was the return to our normal class proceedings. This prevented them from having additional time to think about the definitions of the words. The findings suggest that secondary students typically remember half of what they are taught without reviewing the information. Two days later, participants took a second recall test, and the class averaged a 2.47 out of 5 (see Table 1). This finding suggests that students remember less
information as more time passes. These results are not surprising, especially since students did not study the words in between recall tests.

**Recall Scores: Class Average with Note Taking Intervention**

When students learned five new vocabulary words and took notes using a note taking strategy that emphasized paraphrasing, they averaged a 3.30 out of 5 on a recall test (see Table 1). This recall test was taken by students one hour after learning the new words. Like the previous recall test, students were not given the opportunity to review the words before taking the test. After learning to paraphrase new information, the class average increased by almost an entire point, jumping from 2.58 to 3.30 (a difference of 0.72) (see Table 1). The results are important because they emphasize the necessity of taking strategic and effective notes in class.

Two days after the initial recall test, participants took a second recall test. The group of students averaged a 2.84 out of 5 (see Table 1). It is not surprising that the scores decreased since students did not review the definitions in between the two recall tests. The significant part of this finding is that, comparatively, this score is higher than the delayed recall test from the week before. The recall scores increased from 2.47 to 2.84, a difference of 0.37 (see Table 1). Again, this finding shows that students can improve their recall of recently learned vocabulary without much note taking effort at all. The result reflects students’ raw memory of the learned words, which is promising since there are many other study tools they can use to increase their memory (such as reviewing notes, connecting learned words to previously learned information, creating mnemonics, etc.).
### Table 1

**Recall Scores: Class Averages**

<table>
<thead>
<tr>
<th></th>
<th>Recall Test (no note taking intervention)</th>
<th>Recall Test (with a note taking intervention)</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short Term Recall</td>
<td>2.58 out of 5</td>
<td>3.30 out of 5</td>
<td>0.72</td>
</tr>
<tr>
<td>(taken one hour after learning the words)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Long Term Recall</td>
<td>2.47 out of 5</td>
<td>2.84 out of 5</td>
<td>0.37</td>
</tr>
<tr>
<td>(taken two days after learning the words)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note:* Class recall scores improved when students were taught a note taking strategy that emphasized paraphrasing. This improvement is seen in both short-term and long-term tests.

**Comparing Recall Scores Across Note Taking Mediums**

Nineteen secondary students participated in the research, with fifteen of them taking notes by hand and four taking notes digitally. When students learned five vocabulary words and had the ability to choose their own note taking style and medium (paper versus digital), the digital note takers averaged 1.25 out of 5 on a recall test (see Table 3). This test was taken one hour after participants learned the vocabulary words. On the other hand, physical note takers averaged 2.93 out of 5 (see Table 2) on the same recall test (also taken one hour after learning the words). In the current study, physical note takers scored over a point and half (1.68) higher than their peers who preferred digital note taking.

Participants were given another recall test two days after learning the vocabulary words. When students had the ability to choose their own note taking style and medium (paper versus computer), the digital note takers averaged 1.75 out of 5 on the recall test (see Table 3). On the other hand, the physical note takers averaged 2.60 out of 5 on the same recall test (see Table 2). Not surprisingly, the physical note takers' scores decreased after two days of not reviewing the
five words. While this result was expected, the digital note takers improved (changing from 1.25 to 1.75) their scores from two days earlier (see Table 3). The average score of 1.75 is still comparatively low, however it is worth looking into.

One week after these initial recall tests, students learned five new vocabulary words and took notes using a modeled note taking strategy on a medium they preferred (paper versus computer). When participants took the recall test an hour later, the digital note takers averaged 3.0 out of 5 (see Table 3). The physical note takers averaged 3.4 out of 5 on the same test (see Table 2). These findings reflect two main ideas. First, when students were taught how to effectively take notes, all recall scores improved (for both physical and digital note takers). Participants who took notes on their computer saw a significant increase in their average scores. Jumping from an average of 1.25 to 3.0 (a difference of 1.75) (see Table 3), digital note taking students greatly benefited from paraphrasing their notes. It appears that this note taking adjustment is highly beneficial for those who prefer to take notes on their computer.

Two days later, student participants took another recall test on the same vocabulary words taught 48 hours earlier. The digital note takers averaged 3.0 out of 5 on a recall test (see Table 3). This is a significant jump from the previous result of 1.75 (without any note taking strategy). It is worth noting, however, that the delayed score of 3.0 is the same as the score of 3.0 that was taken two days earlier. Meanwhile, the physical note takers averaged 2.80 out of 5 on the delayed recall test (see Table 2). The average score increased from 2.60 to 2.80, which demonstrates that the note taking strategy helped students remember more information, even two days after it was taught (see Table 2). Interestingly, the digital note takers scored higher than the physical note takers.
### Table 2

**Recall Scores: Physical Note Takers**

<table>
<thead>
<tr>
<th></th>
<th>Recall Test (no note taking intervention)</th>
<th>Recall Test (with a note taking intervention)</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short Term Recall (taken one hour after learning the words)</td>
<td>2.93 out of 5</td>
<td>3.40 out of 5</td>
<td>0.47</td>
</tr>
<tr>
<td>Long Term Recall (taken two days after learning the words)</td>
<td>2.60 out of 5</td>
<td>2.80 out of 5</td>
<td>0.20</td>
</tr>
</tbody>
</table>

*Note:* The scores presented here reflect the recall scores of physical note takers, seen both in short and long-term tests.

### Table 3

**Recall Scores: Digital Note Takers**

<table>
<thead>
<tr>
<th></th>
<th>Recall Test (no note taking intervention)</th>
<th>Recall Test (with a note taking intervention)</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short Term Recall (taken one hour after learning the words)</td>
<td>1.25 out of 5</td>
<td>3.00 out of 5</td>
<td>1.75</td>
</tr>
<tr>
<td>Long Term Recall (taken two days after learning the words)</td>
<td>1.75 out of 5</td>
<td>3.00 out of 5</td>
<td>1.25</td>
</tr>
</tbody>
</table>

*Note:* The scores presented here reflect the recall scores of digital note takers, seen both in short and long-term tests.

### Conclusion

Upon researching note taking, two major themes became evident: “Student Perceptions of Note Taking” and “Note Taking and Its Effect on the Recall of Information.” Three sub-themes became evident upon researching the question, *what are secondary students’ perceptions of note taking?* The first sub-theme emphasized that most students were taught to use Cornell notes in
their history as a K-12 student. This finding is significant because it reveals a somewhat universal approach to teaching note taking at the middle school or early high school level. Additionally, student responses revealed a second sub-theme that indicated inconsistencies among the methods that students used for taking notes in the classroom. While most students indicated that they no longer took Cornell notes, they did not have a common note taking strategy that replaced this one. This finding, along with the data that supports the benefits of paraphrasing notes, reveals that most students are using a note taking strategy that is detrimental to their learning. Finally, responses from participants revealed a third sub-theme in the research that highlighted student motivation. In the survey, half of student participants explained they only review their notes when they study for a test. This finding showcases the perspective of students, especially regarding how much priority they give to a test. The second stage of the research also revealed three sub-themes.

The three sub-themes revealed during the second stage responded to the research questions, *how does explicit teaching of a note taking strategy impact recall with secondary students in a 10th grade English class?* and *how do recall scores differ when secondary students in a 10th grade English class take notes on a Chromebook compared with a piece of paper?* Regarding the first of these two research questions, two sub-themes were evident. The first sub-theme revealed that the class averaged a 2.58 out of 5 on a recall test taken one hour after learning five new vocabulary words. Two days later, the class averaged a score of 2.47. When students learned five new vocabulary words and took notes using a note taking strategy that emphasized paraphrasing, they averaged a 3.30 out of 5 on a recall test. Two days later, the class averaged a 2.84 out of 5. These findings indicate that the explicit teaching of a note taking strategy positively impacts recall of learned information. In all conditions, recall scores increased
when students took paraphrased notes.

The final sub-theme addressed the third and final research question. This sub-theme indicated the discrepancies between physical and digital note takings. Results affirmed that physical note takers performed better than digital note takers with and without the note taking intervention on the short-term recall test (taken one hour after learning the vocabulary words). On the long-term recall tests, physical note takers performed better without the note taking intervention. When participants were taught the note taking medium and tested two days later, digital note takers scored better than their peers taking notes by hand. In summary, on three of the four recall tests, physical note takers performed better than those who were taking notes on their computers. These results answer the research question by indicating which note taking medium promotes encoding, therefore improving memory.
Chapter 5: Discussion

The results of the current study reflected two major findings from the literature regarding note taking and its effect on recall. First, the data indicated that the implementation of paraphrasing improved students’ recall of vocabulary words. This finding aligns with the literature, as it emphasizes the importance of paraphrasing and highlights its effect on encoding. Kobayashi (2005) explains that when students are told to make a summary, paraphrase information, or identify the main idea, they encode more information from a text. When students do not summarize or paraphrase their notes, information is encoded less because the connection to the new material is weaker (Kobayashi, 2005). Similarly, students’ tendency to write verbatim notes is detrimental because it prevents the brain from deeply encoding new material (Haynes & Williams, 2015). These findings emphasize the importance of addressing students’ note taking behaviors.

Second, the findings indicate that writing down new information allows the brain to encode information in a way that is deeper than when notes are taken online. The brain, consequently, can recall more information because it is encoded more thoroughly. In addition, this result amplifies the idea that digital note takers are not encoding all content they are learning, which sheds light on the discrepancies between physical and digital note takers. The results highlight what many researchers have been arguing for decades: taking notes on paper is more beneficial than taking notes on a computer.

Mueller and Oppenheimer (2014) found that laptop note takers took notes verbatim, whereas physical note takers summarized important information. Consequently, students who took notes on their computer had shallower encoding than those who took notes by hand. Recent research by Luo, Kiewra, Flanigan, and Peteranetz, (2018) concluded that physical note takers
wrote fewer words and used more images and signals in their notes. These note takers also paraphrased information more than digital note takers and performed better on assessments when given the opportunity to review their notes. These are significant findings considering so much of the educational system is shifting to a digital environment. Schools should be concerned about the learning gap between these two mediums of note taking.

In looking at the recall data as a whole, it became apparent that students should be paraphrasing their notes on a piece of paper. The combination of these two actions will increase recall of learned information. On the flip side, the data highlights how detrimental it is to allow students to take notes on their computer and choose their own note taking style. As teachers, we have a responsibility to promote academic success. With this information, teachers can implement concrete strategies to improve student learning.

**Implications for the Literature**

Based on research from both the literature review and the results presented here, there is a need to incorporate student voice into the conversation of note taking at the K-12 level. Mitra (2000) emphasizes a phenomenon seen in the current research - that surveys are a helpful and manageable way for adults to connect with students about their perceptions on the topic at hand. Asking participants to complete a survey on their perceptions of note taking was enlightening because it added a voice to the discussion of effective note taking methods. Without this addition, it would be difficult to learn that secondary students typically learned Cornell notes in their history as a student. This finding is compelling because it highlights that at one point there was a level of uniformity in learned note taking methods. At some point, however, students chose to abandon this strategy. This occurrence adds to the literature and highlights the fact that the lower grades may possess more structure in their learning. It becomes interesting to question
what motivated students to move away from Cornell notes. Further research may be necessary to find out.

Additionally, the research revealed that students have little rationale behind their note taking style, which is hurting their ability to more easily remember learned information. This finding was surprising since students have been taught to take notes. Many students are concerned about their ability to remember information, yet they continue to use a strategy with no foundation behind it. It is possible that students chose the note taking style that would be easiest to complete, for example, writing verbatim notes from a textbook, slideshow, etc. Regardless of the reason why, students should be aware of the most effective ways to take notes to improve their own learning.

**Implications for Practice and Policy**

In analyzing participants’ note taking perceptions, it became apparent that students use a variety of note taking strategies in their everyday learning. The lack of consistency among note taking practices does not necessarily have a negative impact on student learning, especially considering that learning is a very individual process. In recent years, there has been a push to allow students more choice in the classroom. Allowing students to control their own learning can have positive influences, ranging from increasing engagement to helping students know themselves better as learners (Gabriel & Matthews, 2011). While some students may benefit from having the freedom to take notes how they want, others may need a strategy to keep them structured in their note taking process. It stands to reason that there should be some universal note taking strategy that students can use if they feel like they need it.

What is concerning, however, is that very few responses indicated that the students took notes in a way that was allowing for deep encoding. Most students did not seem to know why
they were taking notes in the style they revealed, which leads me to wonder whether they understand the purpose and goal of note taking. This concept might be helpful to include when first teaching students how to take notes. Along with teaching a note taking strategy, students and teachers may benefit from understanding why taking notes is important. If students understand the purpose of a note taking strategy, they may be more inclined to commit to that strategy for a longer period of time.

Results from the recall data highlighted the importance of teaching students how to effectively take notes. In this case, effective note taking occurred in the form of paraphrasing learned information. When participants took notes using this note taking strategy, their recall improved. There was not one condition where recall scores did not improve because of the note taking intervention. The result further emphasizes the importance of taking notes in a meaningful, productive manner. If students rethink how they learn new material, they can remember more information without doing any studying or reviewing. Imagine how well students will understand the school curriculum if they paraphrase information and review their notes. This information will benefit students and teachers, as it provides a concrete step to improve student learning.

Results from the survey also indicated that students are motivated to review their notes when there is an upcoming test. Research tells us that there are two types of motivation: intrinsic and extrinsic (Bénabou & Tirole, 2003). Intrinsic motivation comes from within. In this case, an intrinsically motivated student would review their notes because they want to increase their own understanding of the material. This student’s motivation comes from gaining mastery of the course curriculum. On the other hand, someone who is extrinsically motivated responds to an outside force (Bénabou & Tirole, 2003). For students, this might be the wishes of others (parents,
teachers) or possibly an upcoming test. It would be interesting to study whether intrinsically motivated students recall more information due solely to their study habits and attitude toward learning.

Most participants indicated that they were extrinsically motivated by upcoming assessments when it came to taking and reviewing notes. It stands to reason that those students are more motivated by an upcoming exam, rather than mastering the information. This phenomenon highlights our society’s focus on testing. Students have been trained to review materials before a test so that they get a “good grade.” As much as this finding should be surprising, it sadly reflects the state of the educational system, and this phenomenon stresses the idea that education needs to shift its focus from grades to mastery. Mastery can be achieved when students more easily remember information, which can be facilitated when they paraphrase learned information.

The current findings suggest that students benefit from using physical materials, rather than digital (Chromebooks, laptops, iPads, etc.). This may be a hindrance to families who cannot afford to buy notebooks and binders for six to seven classes. If teachers begin using more physical materials in their classes, families may feel pressure to provide those materials for their student. Unfortunately, most schools and teachers cannot provide these materials for students, so the responsibility falls to the parents and guardians. Equity issues can arise if some students are set up for success while others are not. If schools are at all concerned with improving student learning, they should consider allocating funds to ensure that all students have a notebook at the beginning of the school year.

Limitations of the Study and Directions for Future Research
Several limitations to this study exist. First, only four participants took notes on their computer, compared to the fifteen who took notes on paper. This ratio may have been problematic because of the small sample size of digital note takers. With only four digital note taking participants, one score may have greatly skewed the recall results. This limitation poses as an explanation for any abnormalities within the recall scores of the digital note takers. One of these abnormalities occurred when digital note takers scored better on the delayed test (taken two days after learning the vocabulary words) using their own note taking style and medium. Logically, this finding does not make sense since humans tend to forget information as time passes. It is worth noting possibilities for the improved results.

Along with the ratio of physical to digital note takers, students may have studied before the quiz if they had anticipated the delayed recall test. It is highly possible that a few of the computer note taking participants reviewed their notes before the quiz in an effort to improve their score. As discussed in Chapter 3, participants may have felt a connection to the research since I was conducting it, and this may have caused a few of them to study the words so that I was pleased by the results. While this threat to validity is possible, the increase in recall scores is not significant enough to suspect independent studying from participants. Further, students were aware that recall scores would not affect their grade, so it is not likely that they felt any pressure to increase their previous scores. Another possibility could be that some of the participants peeked at their neighbor’s test responses. While I emphasized that the purpose of the test was to assess their memory of the words, some may have felt pressure to receive a “good” score. These possibilities highlight a limitation of the research - that threats to validity may have impacted recall results.
Other limitations include the short data collection window, as well as the small sample size. The entire data collection window lasted three weeks, which may have been confusing to student participants. Ideally, there would have been more time for students to practice paraphrasing so that they felt comfortable using it in their notes. It is possible that some participants did not fully understand the process of paraphrasing, which could have affected the recall results. Additionally, results may be influenced by the small sample size of the participants. There were only nineteen participants, which leaves room for data variation since individual scores have a greater weight on the class average. Had there been a larger sample size, variations in recall scores would be less impactful and the class average would be a more accurate reflection. Based on the discussed limitations, a replication of the study may be an important area of future research to validate the findings of the current study. In this replication, it would be necessary to increase the number of participants, as well as the number of digital note takers.

The current study could be expanded by conducting a comparative analysis of how note taking style affects test scores. Based on the findings in this study, it is apparent that students benefit from paraphrasing their notes. These results are only observed on short quizzes. It would be interesting to investigate the long term effects of effective note taking by having participants paraphrase their notes for an entire unit. At the end of the unit, participants would take a test on the information and these results could be compared to a class that did not paraphrase their results.

Conclusion

The current study was born from a curiosity to investigate note taking. A topic that seemed simple on the surface quickly became an intriguing dive into how students approach
learning. The purpose of the research was to not only determine students’ perceptions of note taking, but to also investigate whether a modeled note taking strategy impacted recall scores, and whether students who took notes on paper performed better than those who did not. On a more practical level, the purpose of the research was to learn more about the population I was teaching so that I could improve my practice as a teacher. Investigating note taking was a practical and accessible project that revealed a phenomenon that I will refer to for the rest of my career.

Overall, the current research highlighted the need to reassess how students take notes. A seemingly simple action has a layer of complexity that greatly impacts student learning. The research reveals that more attention needs to be given to students’ note taking habits and that the responsibility ultimately lies with teachers to ensure that students learn how to effectively take notes. Teachers should feel comforted to know that improving student learning is as simple as teaching them how to paraphrase. Similarly, these findings should provide hope to students looking to improve their learning and memory.

At the beginning of this project, I asked the question, if we can improve students’ performance in the classroom just by changing their note taking style, why wouldn’t we do that? Upon the completion of this study, we know that changing students’ note taking style does in fact improve performance in the classroom. The question now becomes, how do educators best implement this finding in the classroom?
References


[https://doi.org/10.1016/j.compedu.2009.07.014](https://doi.org/10.1016/j.compedu.2009.07.014)


https://doi.org/10.1002/acp.3240


Appendix A - Student Perceptions Survey Questions
1. How do you prefer to take notes? (Participants were given the option between “on my computer,” “on a piece of paper”)

2. Why do you prefer to take notes on your computer, on a piece of paper?

3. Have you been taught to take notes in school? (Participants will have the option between “Yes” and “No”)

4. What note taking strategies have you been taught in school? If you have never been taught to take notes, please write N/A.

5. Do you currently use the note taking strategy you were taught?

6. Do you regularly take notes in class? Explain how often.

7. Imagine you are sitting in class and your teacher asks you to take notes on new academic terms. These terms, as well as their definitions, appear on a slideshow. What is your note taking process? List three steps.

8. After you take notes in class, do you ever review your notes?
Appendix B - Recall Test Questions
Vocabulary Quiz #1

1. What is the definition of repentant?
2. What is the definition of brusqueness?
3. What is the definition of revel?
4. What is the definition of subdue?
5. What is the definition of sprightly?

Vocabulary Quiz #2

1. What is the definition of improvident?
2. What is the definition of mirth?
3. What is the definition of folly?
4. What is the definition of discern?
5. What is the definition of capricious?
Appendix C - Consent Form
1. I understand that I am being asked to participate as a Participant in a research study designed to examine how note taking strategies influence recall of learned material. This research is part of Emily Lichty’s Master’s Thesis research project at Dominican University of California, California. This research project is being supervised by Dr. Katie Lewis, Assistant Professor, Department of Education, Dominican University of California.

2. I understand that my participation in this research will involve taking a survey about note taking strategies and taking two recall tests on learned material during an in-class lesson.

3. I understand that the results of the recall test will NOT impact my grade in the class.

4. I understand that my participation in this study is completely voluntary, and I am free to withdraw my participation at any time.

5. I have been made aware that all responses will be confidential. All Participants will be identified by numerical code only; the master list for these codes will be kept by Emily Lichty in a password-protected file. Coded data will be seen only by the researcher and her faculty advisors. One year after the completion of the research, all written and recorded materials will be destroyed.

6. I am aware that all study participants will be furnished with a written summary of the relevant findings and conclusions of this project. Such results will not be available until May 1, 2022.

7. I understand that if I have any further questions about the study, I may contact Ms. Lichty at emily.lichty@students.dominican.edu or her research supervisor, Dr. Lewis, at katherine.lewis@dominican.edu. If I have further questions or comments about participation in this study, I may contact the Dominican University of California Institutional Review Board for the Protection of Human Participants (IRBPHP), which is concerned with the protection of volunteers in research projects. I may reach the IRBPHP Office by calling (415) 482-3547 and leaving a voicemail message, by FAX at (415) 257-0165, or by writing to the IRBPHP, Office of the Associate Vice President for Academic Affairs, Dominican University of California, 50 Acacia Avenue, San Rafael, CA 94901.

8. All procedures related to this research project have been satisfactorily explained to me prior to my voluntary election to participate.

I HAVE READ AND UNDERSTAND ALL OF THE ABOVE EXPLANATION REGARDING THIS STUDY. I VOLUNTARILY GIVE MY CONSENT TO PARTICIPATE. A COPY OF THIS FORM HAS BEEN GIVEN TO ME FOR MY FUTURE REFERENCE.

__________________________________________________________
Signature

__________________________________________________________
Date
Appendix D - Proxy Consent Form
Purpose and Background

Ms. Lichty, a teacher at San Marin High School and graduate student at Dominican University of California, is doing a graduate research study to better understand how note taking strategies affect recall of learned material. This information will help students improve their memory of curriculum learned in the classroom, which will lead to heightened performance and confidence.

My child is being asked to participate because they are a student of Ms. Lichty at San Marin High School.

Procedures

If I agree to allow my child to participate in this study, the following will happen:

1. My child will participate in Ms. Lichty’s study, which includes a survey on their thoughts on taking notes.
2. In addition, students will take notes on a class lesson using whatever note taking strategy they normally use. After, students will take a recall test on that lesson (please note that the recall test will not impact their class grade). One week later, students will take notes on a lesson using a note taking strategy taught by Ms. Lichty. They will take another recall test on this material (again, this test will not impact their class grade).
3. All identifying information will be kept confidential.

Risks and/or discomforts

Students may feel uncomfortable if they believe the recall tests affect their class grade. Ms. Lichty will remind students that participation in the study will have no influence on their grade. Students will also be reminded that participation in the study is completely voluntary. Participants can opt out at any time.

Benefits

There will be no direct benefit to me or to my child from participating in this study. The anticipated benefit of this study is a better understanding of beneficial note taking strategies, and how they influence recall of learned curriculum.

Costs/Financial Considerations

There will be no costs to my child/me as a result of taking part in this study.

Payment/Reimbursement

Neither my child nor I will be reimbursed for participation in this study.
Questions

I understand that I can email Ms. Lichty at emily.lichty@students.dominican.edu to ask further questions about the study. If I have any questions or comments about participation in this study, I should first talk with Ms. Lichty. If for some reason I do not wish to do this, I may contact the Dominican University of California Institutional Review Board for the Protection of Human Participants (IRBPHP), which is concerned with protection of volunteers in research projects. I may reach the IRBPHP Office by calling (415) 482-3547 and leaving a voicemail message, or FAX at (415) 257-0165, or by writing to IRBPHP, Office of Associate Vice President for Academic Affairs, Dominican University of California, 50 Acacia Avenue, San Rafael, CA 94901.

Consent

I may request a copy of this consent form, signed and dated, to keep.

Participation in this writing prompt activity is voluntary. I am free to decline to have my child/me be in this study, or to withdraw my child (if a minor) from it at any point. My decision as to whether or not to have my child/me participate in this study will have no influence on my child’s/my status as a student in Ms. Lichty’s classroom.

My signature below indicates that I agree to allow my child/agree to participate in this study.

____________________________________  ______________________
Signature of Parent/Guardian           Date

____________________________________  ______________________
Signature of Participant/Student       Date