The Relationship Between Note-Taking Method And Grade Point Average When Controlling For Act Score And Self-Regulation Ability In Undergraduate Students

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THE RELATIONSHIP BETWEEN NOTE-TAKING METHOD AND GRADE POINT AVERAGE WHEN CONTROLLING FOR ACT SCORE AND SELF-REGULATION ABILITY IN UNDERGRADUATE STUDENTS

A Dissertation presented in partial fulfillment of requirements for the degree of Doctor of Philosophy in the Department of Higher Education The University of Mississippi

by

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ABSTRACT

A sample of 130 students from a mid-sized research university in the southern United States were asked questions about their note-taking practices, particularly about the percentage of classes in which they had taken notes on a laptop for both the previous semester and for their entire undergraduate career. Note-taking method was then entered as an independent variable along with composite ACT score and each students’ score on the Self Regulation Survey (SRS) (Schwarzer, Diehl, & Schmitz, 1999) into a multiple regression analysis to determine the extent to which there is a relationship between note-taking method and grade point average. No significant relationship was found between note-taking method and grade point average for either the fall 2016 semester or for students’ overall grade point average. While there is a relationship between composite ACT score and grade point average, no relationship was found between students’ scores on the Self Regulation Survey and grade point average. Although not a focus of the study, the researcher did find a significant relationship between composite ACT score and note taking method. This relationship merits additional research.
DEDICATION

To Doug, my soulmate and my rock.
LIST OF ABBREVIATIONS AND SYMBOLS

ACT  American College Test
GPA  grade point average.
NTM  note-taking method
SPSS a software package from IBM used for statistical analysis.
SRS  Self Regulations Survey
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CHAPTER 1

INTRODUCTION

Every day across the United States millions of college students attend classes where they listen to lectures and diligently (or maybe not so diligently) take notes. While a number of studies have conducted experiments or performed surveys to determine the function of note taking (Bonner & Holliday, 2006; Di Vesta & Gray, 1972; Kim, Turner, & Pérez-Quiñones, 2009; Landrum, 2010; van der Meer, 2012), and the issues that go along with note taking on a laptop (Bui, Myerson, & Hale, 2013; Carstens, Watson, & Williams, 2015; Fried, 2008; Katayama, Shambaugh, & Doctor, 2005; Kay & Lauricella, 2011; Kraushaar & Novak, 2010; McDonald, 2012; Quade, 1996; Ragan, Jennings, Massey, & Doolittle, 2013; Reimer, Brimhall, & O’Reilly, 2009; Ward & Tatsukawa, 2003), no study has looked at the relationship between the grade point averages of college students and the degree to which they take notes on a laptop (as opposed to by hand) in actual classes when controlling for preexisting achievement (as determined by ACT score) and a student’s ability to self-regulate his or her behavior. Information indicating that students learn more or get better grades when they take notes by hand – or on a laptop – could guide individual professors’ classroom policies related to note taking, or even if professors were hesitant to adopt strict policies about how students should take notes in their classes, professors could provide students with evidence about the best way to take notes to increase learning and allow students to make more informed choices about their note-taking practices.
Nature of the Study

The purpose of this study is to determine whether there is a relationship between note-taking method and grade point average for undergraduate students when controlling for ACT composite score and the ability to self-regulate. Participants are sophomore, juniors and seniors from a mid-sized public research university located in the southern United States. A panel of 3,000 students were invited to participate by e-mail. Students electing to participate were directed to a Qualtrics survey. The first pages of the survey explained the study, asked for consent to participate and for consent to have protected student information from the student’s records at the institution paired with their responses. Even though demographic information and student grade point averages and ACT scores were paired with student responses to the study, the researcher did not have access to the identity of the individual participants.

After completing the necessary consents, students were asked their preferred method of note taking: on paper, on a laptop or portable computer, on a tablet, on a smartphone, or on another type of device. Next, students were asked to estimate the percentage of classes (to the nearest whole ten percent) in which they have taken notes by entering the information using a keyboard in their fall 2016 classes. The same question was asked again, but this time as a percentage of all their undergraduate classes. Finally, participants were asked to complete the ten item Self-Regulation Survey (SRS) (Schwarzer, Diehl, & Schmitz, 1999) to determine their ability to self-regulate their behavior. (While the two questions concerning note-taking habits seemed awkward – “entering the information using a keyboard” – the question was designed to
separate those who wrote their notes out long hand on a device such as a tablet from those who used a device such as a laptop that actually had a keyboard to type on.)

In order to determine whether there was a statistical relationship between note taking method and grade point average, a multiple regression test using SPSS was selected. The test was performed twice: once for the fall 2016 data and once for all undergraduate data for the participants. Three independent variables were used for each test: (1) the percentage of classes in which notes were taken on a keyboard, (2) ACT composite score, and (3) the participant’s score on the SRS. The percentage of classes in which notes were taken on a keyboard and the SRS were embedded in the survey, and the ACT composite score was pulled from the institution’s records with the student’s permission. The dependent variable was the participant’s grade point average. For the first regression it was the participant’s GPA for the fall 2016 semester and for the second it was the participant’s overall GPA. These scores were also pulled from institutional records with the participant’s permission. Using multiple regression allowed a determination to be made of how much variability in GPA was due to the combined effect of all three independent variables and to each individual independent variable.

Research Questions and Hypotheses

The research project was developed to determine whether the method of taking notes (either by hand on or a keyboard) contributes significantly to the variance in grade point average when holding ACT scores and self-regulation scores steady?

The corresponding null and alternate hypothesis are:
H$_{0}$: There is no significant relationship between grade point average and percentage of
time taking notes on a laptop versus by hand when ACT scores and self-regulation scores are
held constant.

H$_{1}$: There is a significant relationship between grade point average and percentage of
time taking notes on a laptop versus by hand when ACT scores and self-regulation scores are
held constant.

As mentioned earlier, the two parts of this study looked at the relationship for GPA and
note taking method for a single semester (fall 2016) and for participants’ overall undergraduate
tenure up until the time of the study.

The Literature

There can be little doubt as to the importance of note taking for college students
(Crawford, 1925a; Kauffman, Zhao, & Tang, 2011; Landrum, 2010; Piolat, Olive, & Kellogg, 2011). Studies about the value of note taking date back to 1925 when Crawford (1925b) found
that students perform best on exams when they are allowed to both take notes and review those
notes. Other than studies by McClendon (1958) and Eisner & Rohde (1959), there was limited
interest in note taking research until the 1970s. In an important study in 1972, Di Vesta and
Gray found that students benefitted from the actual act of taking notes and that they performed
even better when they were allowed to review those notes immediately after a lecture.
A great deal of interest has focused on whether students benefit from the encoding aspect of note taking – in other words from the actual act of taking notes in class (Barnett, Di Vesta, & Rogozinski, 1981; Di Vesta & Gray, 1972; Einstein, Morris, & Smith, 1985) – or from reviewing those notes (Eisner & Rohde, 1959; Kiewra et al., 1991; Knight & McKelvie, 1986; Palkovitz & Lore, 1980). Other research has looked at the difficulties that students experience in taking notes (Al Musalli, 2015; Bohay, Blakely, Tamplin, & Radvansky, 2011; Kiewra, 1991; Peverly, Ramaswamy, Brown, Sumowski, & Alidoost, 2007; Piolat, Olive, & Kellogg, 2005; Stefanou, Hoffman, & Vielee, 2008; Titsworth, 2004; van der Meer, 2012; Williams, Weil, & Porter, 2012).

As early as the 1990s, researchers have noted the growing use of laptops to take notes in the classroom (Kalbers & Rosner, 2003), and other researchers have found more and more students bringing laptops to class (Davison & Lazaros, 2015; Kay & Lauricella, 2011; Kobus, Rietveld, & van Ommeren, 2013). However, many scholars have questioned whether the tendency of students to take verbatim notes while typing results in mental processing that is shallower and, therefore, results in less learning (Bui, Myerson, & Hale, 2013; Katayama, Shambaugh, & Doctor, 2005; Quade, 1996; Reimer, Brimhall, & O’Reilly, 2009).

A major problem with laptops is the tendency of students to become distracted, both by applications on their own laptop and by seeing the screens of the laptops around them (Aguilar-Roca, Williams, & O’Dowd, 2015; Annan-Coultas, 2012; Barry, Murphy, & Drew, 2015; Carstens, Watson & Williams, 2015; Fried, 2008; Gupta & Irwin, 2016; Hembrooke & Gaye,
In a well-publicized study by Pam Mueller and Daniel Oppenheimer (2014), the researchers reported that students who take notes by hand learn more than students who take notes on a laptop. The results of the study were published in the press, including in The Wall Street Journal (Hotz, 2016), The Atlantic (Meyer, 2014), The Washington Post (Gross, 2014), and Business Insider (Baer, 2014). Mueller and Oppenheimer divided students randomly into two groups. One group was instructed to take notes on a lecture by hand, and the other group to take notes on a laptop. After a break to work on other tasks, students were tested with both factual and application/conceptual questions about the lectures. On factual questions, both groups performed equally well, but on the higher-level thinking questions, the students who took notes by hand significantly outperformed the students who took notes on a laptop. Aguilar-Roca, Williams, and O’Dowd (2012) also found that students performed better in a college biology class when taking notes by hand and Martin (2011) determined that students in a traditional classroom outperformed students in a computer lab even though the course was in business statistics and students in the class had access to Excel.

However, Quade (1996) found that students who took notes on a laptop outperformed students taking notes by hand when asked factual questions. Bui, Myerson, and Hale (2013) also conducted an experiment in which students taking notes on a laptop outperformed those taking notes by hand.
In spite of limited research focused on the relationship between note-taking method and student learning, there have not been studies that examined the extent to which note-taking method affects grade point average. This study is designed to partially address that gap.

Operational Definitions

ACT – or the American College Test is a college readiness test administered by the American College Testing company. The ACT is taken by the vast majority of student participants prior to their enrollment in college (The ACT Test for Students, 2017).

GPA – common abbreviation for grade point average. A regression was run with GPA from just the fall semester as the dependent variable (GPA.fall2016) and a separate regression with overall GPA as the dependent variable (GPA.overall).

NTM – note-taking method. NTM.fall2016 is the percentage of classes for the fall 2016 semester that participants self-report taking notes using a keyboard. NTM.overall is the percentage of classes in which participants self-report taking notes on a keyboard based on all undergraduate classes that students have taken.

SPSS – a software package from IBM used for statistical analysis. SPSS stands for Statistical Package for the Social Sciences.

Self Regulations Survey, or SRS – a ten item instrument designed to measure an individual’s ability to control his or her actions in order to achieve a particular outcome or goal (Schwarzer, Diehl, & Schmitz, 1999).

Self-regulation ability (or the ability to self-regulate) – a student’s ability to control his or her actions in the present to achieve a particular goal in the future. For purposes of this paper,
self-regulation ability is determined by a student’s score on the Self Regulation Survey or SRS (Schwarzer, Diehl, & Schmitz, 1999). Student participants in this study took the SRS to determine the extent to which any possible difference in grade point average between students who take notes on a laptop who take notes by hand is attributable to a student’s inability to self-regulate and, therefore, easily become off task in the classroom.

**Scope**

This study was limited to sophomore, junior and senior college students at a medium-sized research university in the southern United States. Freshman did not participate since the study included grade point averages as the dependent variable and first semester freshman do not yet have a GPA.

**Limitations**

Participants were asked to estimate for both a single semester and for their entire tenure at the university the percentage of classes in which they have taken notes on a laptop and in which they have taken notes by hand. A major limitation of the study is that students may underestimate or overestimate the percentage of classes in which they have taken notes by either method. Another limitation is that the SRS is also based on students’ self reports concerning
their own abilities to postpone gratification in order to reach long term goals. While some students may be able to objectively view their own ability to self regulate, many may not.

While the panel was selected at random, only students who elected to log into the survey participated and there may have been some traits that these students had in common that others did not. Additionally, students were offered the opportunity to win $10 for beginning the survey and this factor may have also skewed the sample in some manner.

Finally, the delivery method of some types of classes may not be consistent with note taking (either on a laptop or by hand). Examples of these classes might include labs or performance classes. A student who has been enrolled in a number of these classes would have his or her grade point average less affected by note-taking method.

**Significance of the Study**

Studies as to whether students do better when taking notes by hand or on a computer have produced mixed results (Aguilar-Roca, Williams, & O’Dowd, 2012; Bui, Myerson, & Hale, 2013; Martin, 2011; Mueller & Oppenheimer, 2014; Quade, 1996). One study compared students involved in actual classes over the course of an entire semester (Martin, 2011), but no studies have looked whether overall grade point averages are influenced by method of note taking. This study also included a student’s ability to self-regulate and composite ACT score as independent variables. These factors have not previously been considered by researchers.
Finally, and most importantly, if students actually can improve their grades by taking notes by one method or another, students would certainly benefit by having this information.
CHAPTER 2
REVIEW OF THE LITERATURE

The Importance of Note Taking in the College Classroom

As early as 1925, Crawford remarked that taking notes is nearly a universal practice in the college classroom (1925a). Kauffman, Zhao, & Yang (2011) defined note taking as “[t]he act of creating a record of information” and described it as “among the most pervasive learning activities in our educational system” (p. 314). According to Piolat, Olive, and Kellogg (2005), “Note taking occurs in frequent and various everyday life situations. To make purchases, to plan future events and activities, to study for examinations, to prepare a technical talk, to design a model in an industry, and to record the minutes of work meetings are a few examples” (p. 291). Locke (1977) found a significant positive correlation between the completeness of a student’s notes and the grade the student received in class.

Note taking usually occurs in lecture classes, and lecturing continues to be the dominant form of teaching, often supplemented with some form of visual aid, such as a power point or writing on a chalkboard or white board. (Landrum, 2010). In a 2010 study, Landrum found that 87% of faculty expected their students to take notes in class.

Bonner and Holliday (2006) stated that note taking is a “nearly ubiquitous classroom practice,” “a popular learning strategy among students,” and is “encouraged by teachers” (p. 787). Al-Musalli (2015) wrote that note taking is as important for college students as listening
and communicating. Bonner found that 91% of students reported that they usually took notes in class (Bonner & Holliday, 2006, p.796). Titsworth (2004) called lecturing the “sacred cow” of teachers and note taking the “holy grail” of students and found that 99% of students reported taking notes frequently in class (p.306).

Lecturing continues to be the dominant form of teaching in the college classroom and four out of five professors expect their students to take notes in class (Landrum, 2010). Van der Meer (2012) also reported that, “Note taking in lectures is often taken to be the distinguishing characteristic of learning at the university” (p. 12). Stefanou, Hoffman, and Vielee (2008) wrote that, in the typical college classroom, teachers are talking and their students are busy taking notes. And although most students continue to take notes in class, note taking preferences vary greatly from one individual to the next, including what is written down, how it is written, and how it is accessed and studied later (Kim, Turner, & Pérez-Quiñones, 2009).

In 1981, Barnett, Di Vesta, and Rogozinski found that students have better recall of subject matter when they take notes, and stated that this appears to be related to learning that takes place at the time notes are taken.

A Brief History of Note-Taking Research Prior to 1990

A review of the history of note-taking research does not reveal consistent findings through the years. Research results have differed as to the role that note taking plays in student
learning, including the importance of note taking and when students actually benefit from taking notes.

In 1925, Crawford published the results of a series of experiments on college note taking in the *Journal of Educational Research* (1925a). The first study involved 211 graduate and undergraduate students who attended lectures and took notes in their usual manner. After the students took quizzes on the material, their lecture notes were collected and both their notes and their quizzes were graded against the professor’s lecture notes to find the number of concepts from the lecture that appeared. Crawford found that “full, clear, and definite notes” were strongly correlated with better quiz grades (p. 285). He stated that this finding may only indicate that good students not only make good grades, but also take good notes as well. Crawford had I.Q. scores for 66 of the student participants, so he ran his analysis controlling for intelligence, and found that the results did not change: Students who take good notes do better on subsequent tests regardless of their level of intelligence. Crawford also analyzed the particular points that students recorded in notes and on their tests and found that students frequently included concepts in their notes but then later omitted those concepts when being tested; however, students rarely included concepts on a test that they had omitted from their notes.

Crawford then performed a series of seven experiments designed, to not only look at the value of note taking but, to analyze the value of note review (1925b). These experiments included not only traditional lectures, but also class discussions and recitations on the textbook. In some of the experiments students were divided into those who took notes and those who did not. Further, of those who did take notes, some were allowed to review and some were not. He
found that students perform the best when they are not only allowed to take notes, but also allowed to review those notes. This finding was most pronounced when students were given exams that required them to recall and organize the information from the class. On the other hand, when students are given true/false exams, they are just being asked to recognize points from the lecture, and in this case, the students who only listened to the material performed slightly better. Finally, note taking appeared to be most helpful when students are listening to a traditional lecture about new material because the results were not nearly as pronounced when the class had been a discussion or a recitation on the text.

From Crawford to the 1970s, research on note taking was largely neglected except for a couple of studies in the 1950s. In 1958, McClendon conducted a study with 678 freshman students. Students listened to a series of lectures and were divided into four groups: one group took no notes, one group only wrote down the most important ideas from the lectures, one group wrote down as much of the lecture as possible, and the last group was instructed to take notes in their usual manner. Students were tested on the lectures immediately afterward and again five weeks later. No significant differences were found in either immediate or delayed test scores. (At this time in higher education – and contrary to today’s practices, apparently some professors were not allowing students to take notes believing that doing so interfered with their ability to follow the lecture carefully. McClendon pointed out that his results indicated that professors should neither deny students the right to take notes nor should they direct how notes should be taken.)
Eisner and Rohde (1959) conducted an experiment to determine whether college students should take notes during or after class. Students in an English literature class were divided into two groups. On two different lecture days, one group was instructed to take notes during the lecture and the other was instructed to wait until after the lecture to write down their notes, with the two groups trading roles from the first session to the next. The researchers found no significant difference between the two groups when they were tested, both the following day and three weeks later.

Then in 1972, Di Vesta and Gray published an important study on note taking. The researchers stated that note taking could serve two different functions: as “an external storage mechanism” or as “an encoding mechanism” (p. 8). If students actually encode information at the time they are taking notes, this would indicate that they give the new information meaning by linking it to what they already know. On the other hand, if students do not encode the information while listening to a lecture and merely use their notes for storage of information to be studied later, then note taking should be designed to be as efficient as possible.

To see whether students encode at the time notes are taken, Di Vesta and Gray had 120 participants listen to three five-minute lectures and either take notes or not (1972). Additional variables included whether participants were allowed to rehearse the material immediately after the lecture and whether they took a short quiz immediately after that. At the end of all three sessions, students were given a comprehensive test. Students who took notes significantly outperformed those who did not. The researchers stated that, “note taking appears to sensitize the learner to certain aspects of the communication” (p. 13). Furthermore, students who were
allowed to study immediately after each lecture and immediately took a short quiz also performed significantly better than those who did not. The researchers recommended that educators emphasize note taking in their classrooms and find ways to provide for immediate review and quizzes.

In 1975, Carter and Van Matre posed an important question that researchers continue to ask today: Does learning take place when a student takes notes or when the student reviews those notes? When looking at students who listened to a lecture and took notes, the authors found that the students who were able to review those notes significantly outperformed students who did not review. In fact, students who took notes but did not study them performed as poorly as students who took no notes at all.

Also in 1975, Fisher and Harris performed an experiment in which students were divided into five groups. Group one did not take notes, but reviewed the lecturer’s notes. Group two did not take notes, but was asked to mentally review the material after the lecture. Group three took notes, but only reviewed the material mentally. Group four took notes and reviewed those notes after the lecture. Group five took notes, but reviewed the lecturer’s notes. In their results, group four (the group that took notes and reviewed their own notes) did best. Group one (the group that did not take notes, but reviewed the lecturer’s notes) did second best. Group 5, (the group that took notes but reviewed the lecturer’s notes) performed third best. Group 3 was second lowest, and group 2 was the worst. The authors found their results indicated that notes facilitate learning at two times: when the notes are taken and when they are reviewed. One surprising finding was that group 1 (the group that took notes but only did a mental review) outperformed
group 5 (who took notes but reviewed the lecturer’s notes). The authors wondered if somehow reviewing the lecturer’s notes interfered with the way that students had encoded the material when they took their own notes.

In 1977, Locke compared actual notes taken by students in class with a set of ideal notes that covered all the concepts covered in the lecture. On average, students recorded 80% of the material that was written by the professor on the board, and 51% of the material that was in the lecture alone. Locke found a significant positive correlation between the completeness of a student’s notes and the grade that the student ultimately received in class.

On the other hand, Palkovitz and Lore (1980) also looked at the actual notes that students took in class, but found that both students who performed well in class and those that performed poorly had notes that were accurate and complete. The researchers concluded from their results that learning does not take place during the time that notes are taken, but instead at the time the notes are later reviewed. In other words, it is the quality of the review that matters.

In 1985, Einstein, Morris, and Smith compared students who took notes with students who did not and found that students who took notes remembered more important concepts. Students who did not take notes remembered equal numbers of important and unimportant concepts. Therefore, note taking improves the recall of more important concepts, but not all concepts. Furthermore, the authors hypothesized that the main difference between successful and unsuccessful students is the ability to organize and prioritize concepts, although they admit that they did not know how students do this.
The Role of Note Taking in Learning: Student Behaviors and Competing Theories

*Student note-taking behaviors and techniques.* Bonner and Holliday (2006) performed a longitudinal study with college students in a genetics class at a private women’s liberal arts college. Students were interviewed about their beliefs about note taking and they also allowed the researchers to study the notes that they had taken. About half of the students said that they tried to take verbatim notes, and half said that they paraphrased what the professor said. 87% said that the professor’s speed in lecturing affected the quality of their notes, and 96% said that their note taking skills had improved since they started college (p. 796). Students reported that they adjusted their note taking strategies after the first exam in each class. Students overwhelmingly agreed that good notes should be accurate, complete, and well organized. However, when reviewing student notes, the researchers found that student notes rarely met all these standards. The authors concluded the study by stating that most students could benefit from direct instruction on how to take good notes in class. Haynes (2015) also found that the biggest problem facing most students is deciding which parts of the lecture are important enough to write down. This decision-making process should be the focus of interventions.

Reimer, Brimhall, and O’Reilly (2009) interviewed 68 college students about their note taking behaviors. 100% of the students reported taking notes in class (p.897), but also reported taking notes in other environments, including at home, in the library, in labs, and even outdoors. Students augmented their notes with other materials, such as handouts, material printed out from the internet, and other students’ notes. Students reported using their notes to study for exams,
but also for other purposes, including helping them complete assignments and as an aid when reading for class.

Locke (1977) found a significant correlation between the completeness of a student’s notes and the grade the student received in class. Student notes taken at the beginning of a class period were significantly more complete than those taken toward the end of the period, and errors in students’ notes were almost always concepts that were omitted, and not concepts that were recorded incorrectly.

Makany, Kemp, and Dror (2009) divided students taking notes by hand into linear and non-linear note takers. Linear note takers attempt to follow the lecture chronologically, and in basic prose form. Non-linear note takers write less, but impose their own organization onto their notes. Their notes are more likely to include lists, outlines, and symbols. The researchers found that non-linear note takers significantly outperform linear note takers on subsequent testing.

Piolat, Olive, and Kellogg (2005) also found that students who take notes in a non-linear style, including making ample use of outlines and lists, outperformed students who recorded lectures verbatim. This negative correlation between verbatim note taking and performance was seen even when students were taking notes on interactive computer programs (Trevors, Duffy, and Axevedo, 2014). The researchers referred to the verbatim approach to taking notes as “shallow” processing (p. 12) thus indicating that students who take notes verbatim are less engaged with the material.

Kobayashi (2005) found that students who take notes significantly outperform those who do not when taking tests that require recognition and retrieval. However, when a test required
students to recall information without cues, the difference was much less pronounced. The author theorized that the function of note taking is to create cues in the brain to facilitate the retrieval (and not the generation) of information.

Some research has focused on the format in which notes are taken. Crooks, White, & Barnard (2007) studied the use of graphic organizers for students taking notes. Graphic organizers allow note takers to not only record hierarchical relationships, but lateral relationships as well. In this respect, they differ from outlines or list forms. The researchers found that graphic organizers helped students when mastering large, complex relationships with many different concepts, but that students studying less complex material did better when they took verbatim notes in traditional formats.

Kiewra et al. (1991) randomly assigned undergraduate students to take notes in the conventional prose form, in an outline with headings given for the major sections, or in a two-dimensional matrix with topics listed across the top and characteristics associated with each topic down the left side. When students were tested, those who had taken notes in matrix form outperformed the other two groups, followed by those who took notes in outline form. The authors opined that an outline allowed students to think about the hierarchy of topics and subtopics covered in the lecture. Taking notes in a matrix not only allowed students to understand the hierarchy of topics, but also to make horizontal connections.

Kauffman, Zhao, and Yang (2011) divided students randomly into three groups: one group was instructed to take notes in prose form, one group in outline form, and the last group in a two-dimensional matrix. Students listened to information about six kinds of wild cats and they
were instructed to collect specific types of information about each type of cat. Upon subsequent testing, the researchers found that the students who took their notes on a two-dimensional grid outperformed the students who took conventional notes and those who took their notes in outline form. The researchers also found that the students who took notes in the matrix form recorded more complete information in their notes.

Bui, Myerson, and Hale (2013) studied students taking notes on laptops and divided them into two groups: one group was directed to take notes that would be most meaningful to them, while the other group was directed to take verbatim notes. Half of each group was either tested immediately after the lecture, and half after 24 hours. When tested immediately after the lecture, students who had taken notes verbatim performed best, but when tested after 24 hours, the students that organized their own notes performed best.

Shrager and Mayer (1989) found that taking notes did not always improve student learning. College students were given a pretest to discover their knowledge of camera use. Then they were randomly divided into two groups. One group was instructed to take notes on a lecture about photography and the other was not. Students who came to the experiment without previous knowledge of camera use performed better on a post-test when they had taken notes on the lecture. Students who already had some knowledge about camera use performed equally well on the post test whether or not they had taken notes on the lecture. These results seem to indicate that the less an individual knows about a subject, the more he or she will benefit from taking notes during a lecture about it.
Competing theories about the function of notes. While there has been consensus that note taking is an important skill for student success (Bonner & Holliday, 2006; Di Vesta & Gray, 1972; Kim, Turner, Pérez-Quiñones, 2009; Landrum, 2010), it is less clear why it is important (van der Meer, 2012). Considerable research has attempted to answer the question of how note taking fosters student success: Do students benefit from the actual act of taking notes, encoding the material as it is processed? Or do notes just serve as storage mechanisms for information that students can later go back and study?

Notes primarily serve a storage function. In 1959, Eisner and Rohde conducted an experiment to determine whether students would do just as well on examinations if they took notes after class instead of during class and found no significant difference based on the time notes were taken. The authors began their article by stating, “Though note taking during lecture is strongly advocated by most how-to-study books, one is hard put to find a theory which would advocate the note taking process as a means of learning in and of itself.” (1959, p. 301).

Carter and Van Matre (1975) divided college students listening to a lecture into three groups: one group that took notes and later reviewed them, one group that took notes but did not review them later, and a third group that did not take notes at all. The group that took notes and later reviewed them outperformed the other two groups, and the students who did not review their notes performed about the same as students who did not take notes at all. The researchers wrote that their results indicated that the value of notes is that they provide an external storage function for students so that they can go back and study the material later; the value is not in that students learn the material while taking notes.
Palkovitz and Lore (1980) found that the quality of notes taken in the actual classroom did not vary between high performing and poorly performing students. Both groups were found to have notes that were accurate and complete; therefore, learning must not be taking place at the time notes were being taken, but instead when the notes were later studied.

Knight and McKelvie (1986) had undergraduate psychology students view a short, videotaped lecture. Some students took notes, while others did not. There were also students who received the instructor’s notes, and some of these students did not see the lecture. Students were tested one week later. Students who took notes and reviewed them did better than those who did not review. The students who took notes but did not review them did as poorly as the students who did not take notes at all. The students who received the instructor’s notes did best of all – even when the students did not see the lecture itself. The authors point out that this result calls into question having professors lecture in class at all. Perhaps students should just receive a copy of the professor’s notes and then class time could be spent on other activities such as class discussion.

Kiewra et al. (1991) performed an experiment with undergraduate students divided into nine groups. First, students were assigned to either (a) listen to a lecture and take notes which were not reviewed, (b) listen to the lecture and take notes that were then reviewed, or (c) not listen to the lecture but study another student’s notes. All students were then tested. The students who listened to the lecture, took notes and reviewed those notes performed best, followed by the students who did not listen to the lecture but studied another student’s notes. Students who took notes but did not study them performed the worst; in fact, those students
performed comparably to students who did not take notes at all. The authors hypothesized that taking notes and reviewing them provides students with two opportunities to learn the material and for that reason that group did best. Furthermore, generative learning (learning that requires making connections to previous learning or between different concepts) can only happen when a student has adequate time to think, and that can only happen when a student is reviewing his or her notes and not under pressure to listen and write at the same time.

The act of taking notes enhances learning. Di Vesta and Gray (1972) compared test scores of students who took notes on lectures with those who did not. Even when students were not given the opportunity to study those notes, they found that students who had taken notes significantly outperformed those who did not. The authors referred to this process as encoding, and stated that, “through encoding, the learner has linked the material to his existing cognitive structure – he has made it meaningful.” (p.8).

Barnett, Di Vesta, and Rogozinski (1981) found that students taking notes have better recall of subject matter than students who do not take notes. He attributed this to encoding taking place at the time the notes were taken, rather than studying the notes afterward. This was true even when students studied the teacher’s notes rather than their own.

Einstein, Morris, & Smith (1985) also found the encoding function to be most important. College students listened to a lecture and were instructed to either take notes or not. Students were tested by asking them to remember as much of the lecture as they could. Students who did not take notes remembered equal numbers of unimportant and important concepts from the lecture. Therefore, note taking appears to enable students to make decisions about the hierarchy
of information presented. In a second experiment, some students were allowed to review notes and then the testing of students was delayed or immediate. Einstein found that reviewing notes was only important when testing was delayed. When testing was immediate, students performed equally well, whether they had reviewed the notes or not. The authors noted that the main difference between successful and unsuccessful students is the ability to organize and prioritize concepts. How students do this was unclear.

**Note taking serves both functions.** As early as 1925, Crawford found that students taking notes outperformed those who did not, even when students were tested immediately after the lecture and not given a chance to review (1925a). In subsequent studies the same year, he also found that students that perform best are students who not only take notes (the encoding function), but also are given a chance to review those notes (the storage function) (1925b).

In 1973, Fisher & Harris found that students who take their own notes and review those notes outperform students who do not take their own notes but review a lecturer’s notes, and students who take their own notes and do not review them, or take their own notes and review a lecturer’s notes. The researchers stated that these results indicate that note taking enhances learning twice, both at the time notes are taken, and later when the notes are reviewed.

Bohay (2011) posited that note taking improves learning because it requires a student to be actively engaged during a lecture or when reading a text. Students taking notes must pay greater attention and, furthermore, must constantly be determining which ideas are important enough to write down. In one experiment, 97 college students read texts and either took notes or not as directed by the researcher. Students who took notes were further divided into two groups,
one which reviewed their notes and one that did not. The note takers significantly outperformed those who did not take notes, especially on exam questions that required higher level thinking, such as application, inference or analysis. This was true regardless as to whether the students had been allowed to review their notes. In a second experiment, where students either took notes or not during a taped lecture, these results were repeated. The researchers found that being able to review notes is not as important as being able to take notes. Additionally, it did not seem to even matter how many notes were taken, as long as they were being taken.

**Difficulties students experience when taking notes.** While professors often take it for granted that students come to college with established note-taking skills, research indicates otherwise (van der Meer, 2012). In fact, it is unlikely that professors could agree on a definition of what constitutes effective note-taking skills.

One reason that note taking can be difficult for students is that it requires multitasking: Students must summarize the concepts and details in a lecture at the same time they are listening to the next part of the lecture, which in turn must be summarized. Al-Musalli said that this amounted to having students “think on their feet” (2015, p. 135). Piolat, Olive, and Kellogg (2005) pointed out that classroom notes are often taken under serious time restrictions, and students are forced to develop time-saving techniques, such as abbreviating, changing syntax, and adjusting format. These time-saving techniques, and their effectiveness, vary greatly from student to student. Kiewra et al. (1991) theorized that students are unable to connect material in a lecture to previous learning while they are taking notes because note-taking places significant demands on attention, both to the lecture and to the act of taking notes.
Lack of handwriting fluency and speed is an obstacle for some students. Peverly, Ramaswamy, Brown, Sumowski, and Alidoost (2007) found that the quality of note taking varied among students and that students who took better notes performed better on subsequent tests. The researchers reported that one of the factors affecting the quality of notes is the handwriting speed and fluency of the student. Similar results were found by Peverly et al. (2013). Their findings indicated that handwriting speed is necessary for good note taking. Furthermore, the 2013 study found that language comprehension is correlated with better notes. (Interestingly, neither the 2007 nor the 2013 study found a relationship between working memory and note taking.)

While it is tempting to think of note taking as merely listening and writing down what one hears, note taking actually requires many skills which, in turn, require several levels of processing (Al-Musalli, 2015). There are the basic skills of listening, understanding the words heard and writing (which may in themselves present problems for students with learning disabilities), but students must also make constant judgments about what is important and what is not, make connections to previous learning, impose organization upon one’s notes, and even infer meaning that may not be explicitly stated (Al-Musalli, 2015). When students have weaknesses in any of these skills, their note taking may suffer.

Some students may have trouble recognizing the key vocabulary that comes up during the course of a lecture. In a study of the note taking strategies of middle school students, Bohay, Blakely, Tamplin, & Radvansky (2011) found that high achieving students not only had more important concepts from the lecture in their notes than low achieving students, but they also
included more important vocabulary from the lecture. The researcher also found that recording more important vocabulary correlates strongly with test scores on the same material.

Inexperienced note takers may grapple with a lecturer’s lack of overall organization or a lecturer’s animated style of presentation. Titsworth (2004) found that, when teachers are very clear about the organization of their lectures (including language that indicates when a new point is being made), students’ notes improve. On the other hand, students took notes with fewer details when a teacher’s lecture is characterized as having immediacy, such as having more expression, more eye contact and more movement in the classroom. These results indicate that students need help understanding the organization underlying a lecture, but get distracted easily by teacher behaviors that catch their attention (Titsworth, 2004). Van der Meer (2012) also notes that students wish instructors would be more explicit in what material should be in their notes.

Stefanou, Hoffman, and Vielee (2008) were interested in finding out whether teacher-provided overhead slides, notes, or power points reduced the amount of mental energy that students expended in class while taking notes, thus allowing students to engage the material at a deeper level. They hypothesized that, when students do not have to record every word the professor says, students will be able to generate new ideas about the material and their notes would reflect that. Fifty-nine college students in either an agricultural economics class or an introduction to psychology class took notes in classes where a power point supplemented the lecture. The researchers photocopied the students’ notes on two different days. Results were discouraging as the students’ notes did not reflect any original thought nor did they indicate that students were actively linking new learning to what they had learned previously. Furthermore,
when students were provided with an entire lecture, the researchers found that students did not make any notes at all, instead, shutting down and not participating. They pointed out that teachers need to think carefully about the amount of material provided to students so that students remain engaged during a lecture.

Williams, Weil, and Porter (2012) suggested that some of the difficulties students experience with taking notes can be overcome by the use of guided notes. With guided notes, the teacher provides a copy of the lecture notes interspersed with blanks though out. During the lecture, the students fill in the blanks as they come to each part of the lecture. The authors argue that guided notes encourage attention without overwhelming students with the need to write quickly. Furthermore, their research indicates that students who use guided notes significantly outperform students who take traditional notes by a full grade level or more.

The Growing Use of Laptops in the Classroom by Students. As early as the mid-1990s, some universities began requiring students to have laptops (Kalbers & Rosner, 2003). The University of Minnesota Crookston required laptops in 1993, Case Western Reserve School of Medicine in 1993, Wake Forest University in 1996, and by 2003, all students in public colleges and universities in Massachusetts were required to have laptops (p. 342-343). Many universities supplied students with laptops, then recovered the cost by adding it to tuition. Universities also recovered the cost of internet service and technical support by shifting those costs to students.

A survey of 100 universities by Kalbers and Rosner (2003) found that 10% of accounting departments were requiring students to have laptops and 15% of universities had at least one
school or department requiring students to have them (p. 345). At this same time, Hembrooke and Gay noted the “ubiquity, pervasiveness, and mobility of new technologies” (2003, p. 2).

In a 2011 study of college students, Kay and Lauricella found that 87% of undergraduate college students owned and used a laptop. Students reported using laptops for a variety of academic tasks including accessing class materials, collaborating with other students, and doing research, but the number one use was for note taking in class.

A 2013 survey of over three thousand college students in the Netherlands found that 96% of students had some type of device that they used for academic purposes, including laptops, tablets and smartphones (Kobus, Rietveld, & van Ommeren, 2013, p.32). While the authors found a positive correlation between family income and device ownership, the correlation was most pronounced for tablet ownership, as students tended to own laptops and smartphones even when family income was relatively low. Although students in the survey overwhelmingly owned an electronic device, only 34% of the men and 24% of the women actually brought a laptop to class to use, mainly because students found having a laptop cumbersome and heavy to carry (p. 36).

Not surprisingly, faculty and students have very different perceptions of the role of technology in the classroom (Baker & Lusk, 2012). Students are much more accepting of technology, find its use more appropriate, and are less easily distracted by its presence. Among students, males are significantly more accepting of technology than females and graduate students find technology more distracting than undergraduate students and are more likely to support a faculty member’s efforts to ban certain types of technology in the classroom.
In 2008, Fried noted a “developing feud” between professors who favor the use of laptops in the classroom and those who do not (p. 906). Professors ban laptops for a number of reasons: because they believe they cause students to take verbatim notes, because students use them for purposes unrelated to what is going on in the classroom, because they create a physical barrier between students and teachers, because they are distracting to students sitting nearby, and because they hurt teacher morale (Murray, 2011). Murray believed that these reasons were related to misinformation and misunderstanding, and that some of the changes in the way students learn in the classroom are related to the learning style of this particular generation.

In 2009, Kim, Turner, and Pérez-Quiñones found that in a graduate computer science classroom, three-fourths of students preferred taking notes by hand to taking notes on a laptop. In 2013, Ragan, Jennings, Massey, and Doolittle studied a large lecture-based geography class and found 59% of students bringing laptops to class (p. 59). The authors surveyed students who did not bring laptops and they received a variety of reasons: 51% of these students said that they simply preferred to take notes by hand, 30% said that they did not have adequate access to electrical outlets or the internet, and 18% responded that they found laptops to be distracting (p. 81).

Davison and Lazaros (2015) surveyed students with an online questionnaire and found that 90% of students said they used a laptop in class, 45% used a tablet, and 60% used a smartphone. The authors did not specify whether students used the devices to take notes in class or for a different purpose, such as accessing course materials.
While this paper focuses on using laptops to take notes in class, the use of technology has been taken farther by instructors who have engaged in flipped teaching (Hao, 2016). In a flipped class, instructors post lectures online and students come to class having already read the text and watched the corresponding lecture. Class time is reserved for more interactive tasks, such as discussion, assignment completion and group work. In a flipped classroom, laptops in the classroom might be used for a variety of purposes, although note taking would not be the most important.

Another use of laptops in the classroom is for response systems that allow students to use their own electronic device (Imazeki, 2014). Like clickers that allow all the students in a class to respond to a true/false or multiple-choice question at the same time, new programs have been developed that allow students to do the same thing using their cell phones, laptops, or tablets. These programs also allow students to respond to open-ended questions.

**General Research on Laptop Use in the Classroom by Students.** Wurst (2008) studied students in three cohorts in a business program at a university. All students were admitted under the same criteria. The first cohort has not provided with laptops; however, the other two (which were admitted after the first) were provided laptops. Students were surveyed about their educational experience. There was no significant different in achievement between the three cohorts based on grade point average. The students in the laptop groups rated their educational experienced as slightly less constructivist than the cohort that did not have laptops available. Furthermore, the students with laptops stated that they were less satisfied with their educational experience.
In a survey of 173 law students, Murray (2011) found that 84% of students always brought their laptops to class and an additional 3.5% usually did (p. 215).

A qualitative study by Annan-Coultas in 2012 of students at a college of health sciences found two-thirds of students surveyed strongly believed that having laptops benefitted them academically, although nearly all students said there were some downsides to having laptops in the classroom. Benefits included being able to communicate easily with faculty, other students and administration, easy access to designated class materials, easy access to supplemental materials (even in the classroom), and the ability to take editable notes quickly. On the other hand, students pointed to distraction as the main disadvantage to having laptops in class. Students said they frequently found themselves lost during a lecture after going off-task, and that their professors seemed to be less confident when students all had their laptops open. Students also said that technical issues, such as interruptions in internet service and short battery life were also problems for them.

Kay and Lauricella (2016) found that students used laptops for a variety of academic tasks, including taking notes, researching class topics on the internet, communicating and collaborating with other students, communicating with the instructor, and accessing class materials.

Laptops and verbatim note taking. According to Makany, Kemp, and Dror (2009), note taking differs from court reporting and stenography in that the student taking notes does not record the lecture word for word. Instead, when taking notes, the student attempts to record meaning. Handwriting is slower than speaking, so students taking notes by hand are recording
the gist of the lecture, rather than recording the lecture word for word. Introducing laptops into note taking may affect whether students record the gist of a lecture, or record the lecture verbatim.

Quade (1996) performed a study in which students were randomly assigned to take notes on a computer-based lesson verbatim, in their own style, or by paraphrasing. Being familiar with the encoding theory of note taking, the author expected students who paraphrased their notes or took notes in their own style to outperform students who took verbatim notes; however, there were no significant differences between the scores of the groups when tested one week after the lessons were completed.

Katayama, Shambaugh, and Doctor (2005) had students take notes on a text using one of two methods: one group cut and pasted notes from the text directly into their notes while the other group actually typed up notes, paraphrasing the text. Students were tested one week later on both factual knowledge and application. While the groups’ scores did not differ significantly on the test of factual knowledge, students who had composed and typed their notes significantly outperformed the cut and paste group on the test requiring that they apply their learning.

Bui, Myerson, and Hale (2013) divided students taking notes on a computer into two groups: one group instructed to take notes verbatim and one group instructed to organize their notes in a manner meaningful to them. Both groups were further divided into two groups: one that was tested immediately afterward and another that was tested 24 hours later. In the two groups tested immediately after the lecture, the students who had taken notes verbatim outperformed the students who had organized their own notes, but in the groups tested 24 hours later there were no significant differences between the scores of the groups.
later, the group that organized their own notes outperformed the group that took notes verbatim. The authors attributed this difference to the fact that the group organizing their own notes was required to process the material at a deeper level.

Bui and Myerson (2014) followed the above study with another in which students, divided into groups that either took notes verbatim or organized their own notes, were further divided into groups that were allowed to study their notes for five minutes immediately after the lecture or not allowed to study. When students returned later to be tested, of the students who were allowed to study their notes for five minutes, the students who took verbatim notes outperformed the students who organized their own notes. However, this result was reversed in the group that was not allowed to study their notes for five minutes. In this group, the students who organized their own notes outperformed those who took notes verbatim.

Reimer, Brimhall, and O'Reilly (2009) found that approximately half of the students they surveyed reported that they learned better when taking notes by hand, and students tended to have strong feelings about whether they preferred to take notes by hand or on the laptop. When asked open-ended questions about the advantages and disadvantages of handwritten note taking, students responded that handwriting their notes enhanced their memory for the material and made it easier to insert graphics, symbols, and drawings in their notes. As to taking notes on a laptop, students responded that typed notes were easier to read, easier to edit, and were faster to take than handwritten notes. The downsides of typing notes included having to lug heavy equipment to class, having batteries die in class, difficulty in inserting graphics, and greater difficulty in remembering the material.
Ward and Tatsukawa (2003) stated that for computers to be widely used in classes where extensive graphics or drawings are included, there must be multiple ways to input data, such as the keyboard and a stylus or pen.

**Laptops as distractors.** Fried (2008) studied college students in a general psychology class in which students were allowed to bring laptops. Wifi was provided and students were not given any limitations on how the laptops could be used. Students were surveyed about their laptop use during a ten-week period. During a 75-minute lecture, students reported being off task about 17 minutes (p. 910). While off task, students reported checking e-mail (85%), instant messaging (68%), surfing the internet (43%), playing games (25%), and other activities (35%) (p. 910). Because the students were self-reporting their off-task activities, the researchers stated that students may well have been underestimating their time off task. When comparing performance in the classroom between students who used laptops with those who did not, student laptop use was found to be negatively correlated to performance.

Kay and Lauricella (2011) surveyed undergraduate students and found they were distracted by the use of laptops by other students. Students also reported being off-task by communicating with other students and entertaining themselves with videos or games. One fourth of the students surveyed said they spent over half their time in class instant messaging their friends. McDonald (2012) solved the problem of other students being distracted by laptop users by putting all laptop users at the front of the class. If a student viewed a laptop user who was obviously off task, the student was instructed to point to the offender’s screen. The offender lost three points off his or her grade and the student pointing out the offender received three
points. While this solution might seem to sow discord within the classroom, McDonald reported that 87% of her students wished the entire university would adopt the system (p. 130).

Kraushaar and Novak (2010) asked students to install spyware on their computers that would record the time spent on class-related websites and other activities. Student participants were reassured that their data would be recorded anonymously. The researchers found that 62% of the screens opened were not related to the class (p. 249). Although time spent instant messaging was negatively correlated with class performance, the researchers were surprised to find that other multitasking activities only had a limited effect on performance. The researchers posited that students engaged in multitasking may have put in extra effort outside of class to make up for time spent off task in class.

A 2013 study by Ragan, Jennings, Massey, and Doolittle found that students spent much more time off task. When surveyed, students with laptops reported being off task 61% of the time, and when observed they were found to be off task 63% of the time (p. 84). These figures seem to be a dismal report of student laptop use in the classroom, but the authors also pointed out that banning laptop use in classes would have a negative impact on students who actually are using their laptops to take notes.

Carstens, Watson, and Williams (2015) conducted a study of students in a highly structured psychology course. During certain units of the class, students were allowed to bring laptops and use them for any purpose so long as they participated in class. At the end of the course, there was no significant different in grades between the laptop users and the students who took handwritten notes. One surprising result was that students who brought laptops to class
participated more than students who did not. The authors noted that all the materials for the class were posted online, and that students may have participated more when using laptops because they were able to access those materials during discussion. Had the materials not been online, this effect may not have been observed.

In a very small study, Kim, Turner, and Pérez-Quiñones (2009) found that students taking notes by hand made use of more charts, symbols, brackets and arrows than students taking notes on laptops. Students taking notes on laptops were, however, much more likely to record more of the actual lecture itself. Both groups expressed the need for speed as an important factor in deciding how to take notes in class.

Researchers have questioned whether the use of laptops in a class has a negative effect on students sitting nearby. To answer this question, Aguilar-Roca, Williams, and O’Dowd (2015) divided a college biology class into two sections: one in which the use of laptops was allowed and one in which no laptop use was allowed. Students taking handwritten notes were allowed to sit in either section. Researchers noted that, at any particular time, a significant number of students using laptops were off task. Students who took notes by hand reported that being near laptop note takers was distracting, due to both seeing screens and hearing the sound of typing, and both handwritten and laptop note takers reported that they preferred having the class divided this way. Fried (2008) also reported that students were distracted by the use of laptops by other students. In a survey of students in a class that did not limit laptop use in any way, 64% of students reported that they were distracted by other students using laptops (p. 911).
In a study of students in a health professions college, Annan-Coultas (2012) found that students nearly all found themselves distracted by their laptops in class. Unfortunately, the same thing that made their laptops distracting – the ability to be on the internet – was also the thing that made having a laptop most useful, as nearly all students said that they used the internet to help clarify a concept during the lecture that they did not understand. Turning off the internet would stop some of the distractions, but would also undermine the greatest value in having a laptop in class.

Barry, Murphy, and Drew (2015) surveyed 63 college students about their in-class use of technology and also found extensive off-task behaviors. Students reported being off-task for practical reasons (such as taking care of personal business), as a distraction from a boring lecture, or because they simply could not control themselves. The authors suggest that professors need to change their in-class methods so that students have a reason to remain on task. For instance, students should believe that they can learn something from the activity going on in the class room that they cannot achieve anywhere else. One idea is to post lectures on-line for students to view before class and then have activities or discussion during class based on the lecture.

While students may believe that they can successfully multitask in class, research indicates otherwise (Hembrooke & Gaye, 2003). Attempts to attend to multiple tasks results in poorer performance on all tasks as the brain is not designed to attend to multiple inputs or processing tasks at the same time. Hembrooke & Gay (2003) conducted a study in which students in a college class were divided into two groups that heard the same lecture at two
different times. One group was allowed to use their laptops as they were accustomed, while the other group was instructed not to open laptops during the lecture. A 20-question quiz with both recall and recognition questions followed the lecture. Students who kept their computers closed during the lecture significantly outperformed those who used their computers on the recall (short answer) part of the quiz. They also outperformed the laptop-using group on the recognition portion, but these results were only significant at the $p < .07$ level. Because of the wireless configuration in the classroom, the researchers were able to determine among the laptop users whether students were looking at web pages related to the lecture or unrelated to the lecture. The differences between laptop and non-laptop users was significant even when the laptop users were looking at websites that the professor had recommended to them as related to the topic of the lecture.

Kay and Lauricella (2016) studied undergraduate students and found a correlation between a student’s level of interest in a particular class and the use of his or her laptop on lecture-related tasks such as note taking. The researchers also found that non-academic use of laptops in class negatively correlated, not only with the student’s grade in the class, but also with the student’s overall grade point average.

Gupta and Irwin (2016) manipulated students’ exposure to Facebook notifications on their laptops while listening to lectures that were high-interest or low-interest. Students who were listening to the less interesting lectures were more susceptible to being distracted by the notifications. When a notification required an immediate response, however, student performance was more seriously hampered when the student was listening to a high-interest
Handwritten Notes Versus Typed Notes: Does Either Method Offer Greater Benefits to Students?

Handwritten notes versus typed notes: Which one enhances student learning the most? Research has yielded some mixed results. In 1996, Quade performed an experiment using college students engaging in computer based instruction over a four-week period. Students either took handwritten notes or took notes on the computer. They were further instructed to take notes in their own personal style (by paraphrasing or verbatim) and were provided instruction about how to take notes. Their notes were collected during the experiment to confirm that students were taking their notes by the method and in the style to which they had been randomly assigned. One week after the lessons were completed, students were tested using a variety of questions types. On questions that involved synthesizing information, the student who took notes on the computer and the students who took notes by hand performed equally well. On fact-based questions, however, the students who took notes on the computers outperformed the students who took notes by hand.

Fried (2008) studied students in a general psychology class where no limitations were placed on laptop use and found that laptop use correlated negatively to student performance,
even after controlling for ACT scores, high school rank and level of attendance. Students using laptops reported that they paid less attention, found lectures to be unclear, and felt that they poorly understood the course.

Martin (2011) taught two sections of a business statistics course during the same semester. The classes were identical except for one difference: one class was taught traditionally, and the other class was taught in a computer lab. Students were taught to perform statistical analyses using Excel. Those students in the computer lab were able to actually perform the operations on Excel while following along with the instructor. Controlling for student ability as measured by the mathematics portion of the SAT, students in the traditional course significantly outperformed the students in the computer lab by an average of ten points on each of three exams given during the semester. This result was surprising since it was assumed that students having the benefit of working on Excel in class would have an advantage over those who did not.

In one of a series of experiments, Bui, Myerson, and Hale (2013) had college students record notes under four different conditions: student-organized notes by hand, student-organized notes on the computer, verbatim notes of the lecture by hand, and verbatim notes on a computer. Students were tested immediately afterward with both short-answer tests and free recall. The students who had taken verbatim notes on the computer performed better than any other group, and overall, students who had taken notes on the computer outperformed those taking notes by hand.
Aguilar-Roca, Williams, and O’Dowd (2015) found that, in a college biology class, when controlling for SAT scores, AP scores and a concept test given at the beginning of the class, the grades of students who took notes by hand was under-predicted and the grades of students who took notes on laptops was over-predicted.

In a controlled experiment comparing the performance of students taking notes by hand with that of students taking notes on a computer, Mueller & Oppenheimer (2014) divided students randomly into two groups, with one group taking notes on a lecture by hand and the other on laptops. Following the lecture, students were instructed to work on an unrelated task for a period of 30 minutes. Then a test was administered. Some of the items on the test were purely fact-based, while other items required the students to apply or analyze the material in the lecture. On the questions that were fact-based, both groups of students performed equally well, but when students were challenged with higher level thinking, the group that took notes by hand significantly outperformed the other group. This difference was even more pronounced when testing was delayed over several days.

An important facet of Mueller and Oppenheimer’s 2014 study is that it differentiated between students’ performance on lower level thinking tasks versus higher level (see also Quade, 1996). The idea that different learning tasks require different levels of cognitive effort can be traced to Benjamin Bloom (Adams, 2015). Professors have a significant role in determining how deeply students engage with material based on the type of questions they ask and the type of tasks they assign.
The most basic level of learning is at the knowledge level. Students tested at this level are asked to repeat facts verbatim. The knowledge level is the level of rote memorization (Adams, 2015). Students who can memorize information efficiently can perform well on knowledge-based tasks even though they may have little or no understanding of the words they are memorizing.

The second level is comprehension, a level that demonstrates understanding. To test students’ comprehension, students may be asked to paraphrase information that they have learned. Other comprehension tasks include classifying information into categories or making comparisons between categories of information.

Students must comprehend information before they can apply it in new situations and application is the third level in Bloom’s taxonomy. Application is using information in a variety of situations. An example of application would be asking students to solve word problems using multiplication (Adams, 2015).

The next three levels (four, five and six) are those requiring critical thinking. These are usually the levels to which one is referring when asking students to perform higher level thinking tasks. The fourth level is analysis. Analyzing requires students to break a concept down into its component parts. Such a task might include asking students to differentiate between fact and opinion within an article, or to list the component parts of an argument (Adams, 2015).

Synthesis, the fifth level, involves asking students to make something new from what they have learned. Students synthesize what they have learned when they take facts they have
memorized and use those facts to make a new argument. Or students might be asked to create a work of art by applying skills in a new and novel way (Adams, 2015).

The final level is evaluation, which involves making judgments about the quality of another’s or one’s own creation, idea, or works. Evaluation includes asking students to discuss the merits of an essay or to act as peer editors for each other (Adams, 2015). In later versions of the taxonomy, evaluation is considered the fifth level and creation as the sixth level (Adams, 2015).

Since Mueller and Oppenheimer (2014) found that students who take notes by hand only outperform those taking notes on a laptop when the test requires higher level thinking tasks, then it becomes important to know how students will be tested. Students who are only going to be asked to repeat information that they learned by rote would not experience any benefit from taking notes by hand.

Mueller and Oppenheimer completed their 2014 study by looking at the actual notes taken by students by hand or on laptops. They found that students taking notes on a laptop wrote down significantly more words during the lecture. The researchers hypothesized that students taking notes on laptops were able to record words much more quickly than those taking notes by hand – in essence, these students were taking notes verbatim without having to process the meaning of the lecture. When students took notes by hand, they were slower and had to actually think about paraphrasing the lecture thus processing it at the time they were writing. The researchers reasoned that the way around this problem was to instruct students who were taking notes on laptops not to take notes verbatim, but instead to summarize the lecture in their notes.
Even after being instructed not to take notes verbatim, students taking notes on laptops continued to do so, perhaps taking the path of least resistance.

Patterson and Patterson (2017) examined grades for students who were more or less likely to have computers in the classroom for taking notes. Because their institution allowed professors to require laptops, ban laptops, or have no preference, students were likely to have laptops with them on the days where some classes required them, and to not have laptops on days where they had classes banning laptops. This divided students into two natural groups that would not be based on personal preference among students that might be indicative of some other characteristics.

The researchers found that students performed significantly worse when they took notes on a laptop (in other words, in those classes where they had their laptops with them even though they were not required). Furthermore, this difference was more pronounced for male students, students performing poorly overall, and in quantitative classes. Whether students were tested on the lower levels or higher levels of Bloom’s taxonomy is not clear.

Another recent study was conducted by Carter, Greenberg and Walker (2017) at West Point. All students there are required to take a sophomore-level economics course and students are randomly assigned to their sections. All sections use the same textbook and syllabus and take the same exams. For the study, classes were divided into three groups. One set of classes was allowed to bring laptops or tablets to class although students also allowed to take notes by hand. Another group was allowed to bring tablets to class, but the tablets had to remain flat on the desk in front of the student, allowing students to bring technology into the classroom, but
avoiding the temptation to engage in off-task activities. The last group were the control classes in which students were not allowed to bring any technology to class. Professors whose classes were included in the study had to teach both a control class and at least one of the classes where technology was allowed. Students in the classes where no technology was allowed scored 0.17 standard deviations above students in either of the two technology classes.

**Self Regulation**

Willpower. Self control. Self regulation. These are all terms that refer to an individual’s ability to control one’s behavior in the present in order to achieve a goal in the future (Berger, 2011; Zimmerman, 2008). Self regulation encompasses a wide span of skills such as “paying attention, inhibiting reflexive actions, and delaying gratification” (Berger, 2011, p. 3). Self regulation exists outside of intelligence, aptitude, and ability: Instead, self regulation enables an individual to maximize the value of intelligence, aptitude and ability (Zimmerman, 2008).

Unlike measures of mental ability or academic performance skill, self-regulated learning (SRL) refers to the self-directive processes and self-beliefs that enable learners to transform their mental abilities, such as verbal aptitude, into an academic performance skill, such as writing. SRL is viewed as proactive processes that students use to acquire academic skills, such as setting goals, selecting and deploying strategies, and self-monitoring one’s effectiveness, rather than as a reactive event that happens to students due to impersonal forces. (Zimmerman, 2008, p. 166-167).
Self-regulation has three phases: planning, implementation, and evaluation (Cohen, 2012). The student plans how he or she will achieve a goal, such as setting aside a certain amount of time to study each day for an exam that is still a week away. Implementation means that the plan is followed even when other temptations arise, such as hanging out with friends or playing video games. Finally, after implementing the plan, students with strong self-regulation skills evaluate what parts of the plan and implementation were successful or unsuccessful, and future plans are adjusted accordingly. This may mean setting apart more time to study, but it may also mean selecting an environment in which to study where temptations are minimized, or rehearsing strategies to cope with temptations when they do arise. Zimmerman and Kitsantas (2014) found that, for high school students, self-regulation significantly predicted student grade point averages. The authors suggested that teachers should identify students with poor self-regulation skills and help them develop better learning processes.

However, research is divided as to whether the ability to self regulate is a stable trait or a malleable skill that can be developed with effort (Diehl, Semegon, & Schwarzer, 2006). If self regulation is malleable, then individuals can be taught how to better control their actions in order to achieve long term goals. If it is a stable trait, then it becomes more difficult for students who have poor self-regulation skills to cope with temptation and any effective strategies probably depend on avoiding temptation in the first place.

**Students have difficulty regulating their behavior when using laptops in class.**

Laptops in the classroom present students with a variety of temptations: internet surfing, instant messaging and chatting, game playing (Aguilar-Roca, Williams, & O’Dowd, 2015; Annan-
Students who perform poorly in classes in which they take notes on a laptop may do so because laptops also bring distractions. If a student who has poor self-regulation skills takes notes by hand, he or she may have limited opportunities to become off task. If that same student brings a laptop to class, he or she may spend the entire class involved in activities unrelated to the lecture. Aguilar-Roca (2015) found that, in a college biology class, when controlling for SAT scores, AP scores and a concept test given at the beginning of the class, the grades of students who took notes by hand were under-predicted and the grades of students who took notes on laptops were over-predicted. The researchers noted that, throughout the class, a large number of laptop note takers were off-task, raising the question of whether the difference in exam grades could be explained by a lack of self-regulation in the students taking notes on a laptop.

Fried (2008) studied college students in a class that placed no limitations on the use of laptops. Students were surveyed about their computer use in the classroom and students reported spending 17 minutes out of each 75 minute lecture in activities unrelated to the class. (2008, p. 910). These off-task periods included time spent checking e-mail, instant messaging, surfing the internet and playing games. The time spent off task was self-reported by students, and may well have been underestimated.
In a lecture class, attending to the lecture should be the dominant activity in the classroom (Lindroth, 2010). The use of laptops presents a unique set of temptations for students as it makes it extremely easy for the student to switch to another activity, such as checking e-mail, surfing the web, or instant messaging. Lindroth (2010) writes that one way for professors to mediate this issue may be to spell out expectations and laptop etiquette at the beginning of a course, before students have surrendered to temptation, but whether this practice would be successful is unclear.

While some researchers view self regulation as a cognitive process where students choose to self regulate and then implement necessary steps (Cohen, 2012, Zimmerman, 2008), Aagaard (2015) theorizes that most students who use their laptops to be off-task in the classroom are not making a conscious choice. The author studied students in a business school in Denmark. After observing students for several months in a variety of classes, she interviewed them about their laptop use in class. Students seemed surprised to even being asked if they were off-task during class: “Of course,” they were! (p. 93). When asked why, students frequently answered that they often do not realize that they have logged on to Facebook or another site they frequent until they have already been on the site for several minutes. In other words, the students were not making a conscious choice but were acting out of habit. Students admitted that this was most likely to happen when the material in the lecture was very difficult and they were growing fatigued with trying to keep up, or when the material was so easy as to be boring (Aagaard, 2015). Barry, Murphy, and Drew (2015) found that college students they surveyed also talked about being unable to control their compulsion to go online during class.
Aagaard refers to this subconscious decision to go off-task as “mediated impatience” (2015, p. 95). Students may always experience impatience with a lecture, but now that students have access to the internet, that impatience is mediated by the presence of technology with which students have long-standing ingrained habits. Students who successfully fought the impulse to go off-task frequently did so by closing their laptops all together, thus removing the temptation (Aagaard, 2015).

**ACT Score**

According to its website, the American College Test (ACT) is “the nation’s most popular college entrance exam and valued by all universities and colleges in the United States” (The ACT Test for Students, 2017). The ACT test is intended to be a curriculum-based achievement test, developed in 1959 as an alternative to the SAT; however, when correlated with tests designed to measure general intelligence, it is indistinguishable (Koening, Frey, & Detterman, 2008). Qiu and Wu (2011), in a study of 447 high schools in Missouri, found that ACT scores were higher in schools with more experienced teachers, larger class size, higher levels of parent education, higher family income, and more double-parent families. Powell and Steelman (1996) found a significant relationship between ACT scores and the amount a state spends per pupil on education.
CHAPTER 3
METHODOLOGY

Study Design

The purpose of the study was to determine whether there is a significant relationship between note-taking method and grade point average when controlling for ACT composite score and self-regulation. Note-taking method was defined as the percentage of classes in which a student reported taking notes on an electronic device (such as a laptop) using a keyboard: the higher the percentage, the more classes in which the student typed his or her notes. (Knowing that some students may take notes long hand on a tablet using a stylus, the decision was made to ask students specifically about the use of a keyboard to take notes.)

The primary research question can be stated as:

Does the method of taking notes (either by hand or on a keyboard) contribute significantly to the variance in grade point average when holding ACT scores and self-regulation scores constant?

Prior to inviting any participants to take part in the study, the researcher requested permission from the Institutional Review Board at the institution. The application to IRB is included as Appendix A.
The study looked at this question for both (1) overall grade point average (GPA.overall) and overall note-taking method (NTM.overall), and (2) for grade point average and note taking method for just the fall semester of 2016 (GPA.fall2016 and NTM.fall2016 respectively).

Self regulation was measured using the ten question Self Regulation Survey (SRS). Scores on the SRS can range from 10 to 40, and the higher the score, the more a student reported engaging in behaviors requiring self regulation or self control. Grade point averages and ACT composite scores were taken directly from the Office of the Registrar (with identifying information removed).

Participants included sophomores, juniors and seniors at the University of Mississippi in the spring semester of 2016. Freshman were not invited to participate because their grade point averages at the time of data collection only consisted of a single semester’s grades. An e-mail invitation (Appendix B) was sent to 3000 randomly selected students. As an incentive, students who clicked on the link were informed that they would be entered in a drawing to win $10 prizes. While 287 of these 3000 (9.5%) students opened the link, only 130 (4.3%) students actually responded to all the items and had a composite ACT score on file. It was these 130 students whose responses were included in the study.

Students who clicked on the link were taken to a Qualtrics survey (Appendix C). The initial pages of the survey were consent forms. Students were asked to consent to participating in the survey, and then asked to allow FERPA-protected information to be used in conjunction with their responses from the survey. Students who clicked on responses showing that they did
not consent to either requests were directed outside the survey to a final page thanking them for their time. Following the two consent forms the actual survey began.

The survey included three questions focusing on note-taking methods:

(1) In classes where you take notes, do you usually take notes on paper or on an electronic device of some kind?
   a. On paper
   b. On a laptop or portable computer
   c. On a tablet
   d. On a smartphone
   e. On another type of device (please describe)

(2) Please consider the classes you took during the fall of 2016. In those courses, please estimate the percentage of classes in which you took notes using a keyboard.
   (Students were given choices from 0% to 100% in increments of ten.)

(3) Please consider all the classes you have taken as an undergraduate. To the best of your ability, please estimate the percentage of those classes in which you took notes using a keyboard.
   (Students were given choices from 0% to 100% in increments of ten.)

In the study, scores for note-taking method (NTM), therefore, represent the percentage of classes in which students reported taking notes on an electronic device using a keyboard for either the fall of 2016 (NTM.fall16) or for their entire undergraduate career (NTM.overall). Higher scores indicate greater use of a keyboard for note taking.
Self regulation scores were obtained using the Self Regulation Survey (SRS). The SRS (found in Appendix C) was chosen as the instrument for measuring participants’ self-regulation abilities (Schwarzer, Diehl, & Schmitz, 1999). Rather than an instrument based on observation, the SRS is a survey of the participants. It has only ten statements, which the participant applies to himself or herself, and then selects on a Likert scale whether each statement is “not at all true,” “barely true,” “somewhat true,” or “completely true.”

The statements are:

1. I can concentrate on one activity for a long time, if necessary.

2. If I am distracted from an activity, I don’t have any problem coming back to the topic quickly.

3. If an activity arouses my feelings too much, I can calm myself down so that I can continue with the activity soon.

4. If an activity requires a problem-oriented attitude, I can control my feelings.

5. It is difficult for me to suppress thoughts that interfere with what I need to do.

6. I can control my thoughts from distracting me from the task at hand.

7. When I worry about something, I cannot concentrate on an activity.

8. After an interruption, I don’t have any problem resuming my concentrated style of working.

9. I usually have a whole bunch of thoughts and feelings that interfere with my ability to work in a focused way.
10. I stay focused on my goal and don’t allow anything to distract me from my plan of action. (Schwarzer, Diehl, & Schmitz, 1999).

Each item is scored from one to four points, and then the points are totaled. The maximum possible score is 40 points (Diehl, Semegon, & Schwarzer, 2006). Higher scores indicate a greater ability to regulate one’s behavior. (Answers for items five, seven and nine must be reversed prior to scoring.)

The SRS has been determined to have strong internal consistency, with the correlation between each item and the entire instrument varying from .31 to .61 (Diehl, Semegon, & Schwarzer, 2006, p. 310). Test/retest reliability was measured as .62 (2006, p. 306). Content validity was assessed by comparing students’ scores on the SRS with scores on: a measure of self-efficacy – the Generalized Self-Efficacy Scale, or GSES (Diehl, Semegon, & Schwarzer, 2006, citing Schwarzer & Jerusalem, 1995); a measure of academic self-efficacy – the Academic Self-Evaluation Scale (Diehl, Semegon, & Schwarzer, 2006, citing Wood & Locke, 1987); and a measure of proactive coping – the Proactive Coping Inventory (Diehl, Semegon, & Schwarzer, 2006, citing Greenglass et al., 1999); a measure of depressive symptoms – the Center for Epidemiological Studies Depression Scale (Diehl, Semegon, & Schwarzer, 2006, citing Radloff, 1977); and with students’ final grades in the classes they were currently enrolled in. All these measures correlated significantly with the SRS at $p < .01$. (All correlations were positive except the correlations between the SRS and the measure of depressive symptoms.) Furthermore, the researchers found that attention control, as measured by the SRS, accounted uniquely for 4.1% of the variance in academic performance.
Note taking method and GPA. The null and alternate hypothesis for the research questions are:

\[ H_0: \text{There is no significant relationship between grade point average and percentage of time taking notes using a keyboard versus by hand when ACT scores and self-regulation scores are held constant.} \]

\[ H_1: \text{There is a significant relationship between grade point average and percentage of time taking notes using a keyboard versus by hand when ACT scores and self-regulation scores are held constant.} \]

Data were analyzed with SPSS software using multiple regression with all variables entered at the same time. Multiple regression was selected rather than individual t tests to avoid an inflated Type 1 error rate. Multiple regression also allows the researcher to understand the degree to which each of the independent variables uniquely contributes to the variance in the criterion variable and to determine the degree to which the linear combination of independent variables, or variate, contributes to the variance in the criterion variable.

Participants

Although 287 students began the survey, complete information was obtained for only 130 students. A number of students dropped out while completing the survey. 204 students gave consent to participate. 174 students agreed to having their FERPA protected information accessed. 174 students responded to the question concerning their preferred method of taking
notes. 173 answered the questions concerning the percentage of classes during the fall 2016 semester in which they took notes on a keyboard and 172 answered the question concerning their method of note taking for their entire undergraduate career. Then, the number of students participating dropped significantly, as only 157 students completed the ten questions of the Self Regulation Survey. 27 students’ survey responses were omitted, not because they did not complete the survey, but because there was no composite ACT score on file for them.

Students from a very broad spectrum of schools chose to participate, including students from the College of Liberal Arts, the School of Journalism, the School of Accountancy, the School of Applied Science, the School of Business, the School of Education, the School of Engineering and the School of Pharmacy.

Of the 130 students who completed the survey, 40 (30.8%) were male and 90 (69.2%) were female. 52 (40.0%) were seniors, 41 (31.5%) were juniors, and 37 (28.5%) were sophomores. Freshman were not invited to participate. 107 students were white (82.3%), 14 African-American (10.8%), 4 Asian (3.0%), 2 Hispanic (1.5%), 2 of mixed race (1.5%), and one not reported (0.7%).

**Method**

Students were first asked their preferred method of taking notes. The results appear in Table 1. While 73.1% of students reported that they prefer to take notes on paper, during the fall semester 57.6% of students reported that they had taken notes using a keyboard in at least 10%
of their classes. Less than five percent of students used their keyboards in all their classes, but on average, students reported using computers in an average of one fourth of their classes.

<table>
<thead>
<tr>
<th>Preferred Method</th>
<th>Number of Students</th>
<th>Percentage of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>On paper</td>
<td>95*</td>
<td>73.1%</td>
</tr>
<tr>
<td>On a laptop</td>
<td>31</td>
<td>23.8%</td>
</tr>
<tr>
<td>On a tablet</td>
<td>4</td>
<td>3.1%</td>
</tr>
</tbody>
</table>

*This includes one student who wrote in that “notecards” was his or her preferred method of taking notes

Composite ACT (ACT) score was entered as an independent variable. Student composite ACT scores varied from 17 to 35, with a mean of 26.6, and a standard deviation of 4.61. Self Regulation Score (SRS) was also entered as an independent variable. These scores ranged from 10 to 29 (possible scores are 0 to 40) with a mean of 21.48 and a standard deviation of 3.42.

The average GPA score for the fall of 2016 (GPA.fall2016) was 3.33 and the standard deviation was 0.64. The average for GPAs overall (GPA.overall) was 3.38 with a standard deviation of 0.51.

The third independent variable, and the primary focus of this study, was note-taking method. Although taking notes on a keyboard is practically synonymous with taking notes on a laptop, students were specifically asked about the use of a keyboard to avoid confusion with electronic devices on which an individual can write with a stylus (presumably in long hand). Students were asked to report the percentage of classes during the fall semester of 2016 in which they took notes using a keyboard (NTM.fall2016), and the percentage of classes during their
entire undergraduate career in which they took notes using a keyboard (NTM.overall). The results are in Table 2.

<table>
<thead>
<tr>
<th>NTM, fall 2016</th>
<th>Number of students responding</th>
<th>Percentage of total number of students</th>
<th>Cumulative percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>0% of classes</td>
<td>55 students</td>
<td>42.3% of all students</td>
<td>99.9%</td>
</tr>
<tr>
<td>10% of classes</td>
<td>18</td>
<td>13.8%</td>
<td>57.6%</td>
</tr>
<tr>
<td>20% of classes</td>
<td>8</td>
<td>6.2%</td>
<td>43.8%</td>
</tr>
<tr>
<td>30% of classes</td>
<td>8</td>
<td>6.2%</td>
<td>37.6%</td>
</tr>
<tr>
<td>40% of classes</td>
<td>5</td>
<td>3.8%</td>
<td>31.4%</td>
</tr>
<tr>
<td>50% of classes</td>
<td>7</td>
<td>5.4%</td>
<td>27.6%</td>
</tr>
<tr>
<td>60% of classes</td>
<td>6</td>
<td>4.6%</td>
<td>22.2%</td>
</tr>
<tr>
<td>70% of classes</td>
<td>6</td>
<td>4.6%</td>
<td>17.6%</td>
</tr>
<tr>
<td>80% of classes</td>
<td>5</td>
<td>3.8%</td>
<td>13.0%</td>
</tr>
<tr>
<td>90% of classes</td>
<td>6</td>
<td>4.6%</td>
<td>9.2%</td>
</tr>
<tr>
<td>100% of classes</td>
<td>6</td>
<td>4.6%</td>
<td>4.6%</td>
</tr>
<tr>
<td>Total</td>
<td>130</td>
<td></td>
<td>99.9%</td>
</tr>
<tr>
<td>Average</td>
<td></td>
<td></td>
<td>26.5%</td>
</tr>
<tr>
<td>Standard deviation</td>
<td></td>
<td></td>
<td>32.3</td>
</tr>
</tbody>
</table>

Statistics for students’ use of a keyboard to take notes in all classes throughout their undergraduate tenure indicate that 76.2% of students had used a keyboard in at least 10% of their classes, while 23.8% of students reported never using a keyboard in the classroom (or at least using one less than 10% of the time). While no students reported using a keyboard in all their undergraduate classes, the average was somewhat higher than for the fall 2016, with students
reporting that they had used a laptop in approximately 30% of their classes. These results can be found in Table 3.

<table>
<thead>
<tr>
<th>Percentage of all undergraduate classes taken in which student reported taking notes using a keyboard</th>
<th>Number of students responding</th>
<th>Percentage of total number of students</th>
<th>Cumulative percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>0% of classes</td>
<td>31</td>
<td>23.8% of all students</td>
<td>100.0%</td>
</tr>
<tr>
<td>10% of classes</td>
<td>21</td>
<td>16.2%</td>
<td>76.2%</td>
</tr>
<tr>
<td>20% of classes</td>
<td>16</td>
<td>12.3%</td>
<td>50.0%</td>
</tr>
<tr>
<td>30% of classes</td>
<td>16</td>
<td>12.3%</td>
<td>47.7%</td>
</tr>
<tr>
<td>40% of classes</td>
<td>11</td>
<td>8.5%</td>
<td>35.4%</td>
</tr>
<tr>
<td>50% of classes</td>
<td>5</td>
<td>3.8%</td>
<td>26.9%</td>
</tr>
<tr>
<td>60% of classes</td>
<td>6</td>
<td>4.6%</td>
<td>23.1%</td>
</tr>
<tr>
<td>70% of classes</td>
<td>11</td>
<td>8.5%</td>
<td>18.5%</td>
</tr>
<tr>
<td>80% of classes</td>
<td>11</td>
<td>8.5%</td>
<td>10.0%</td>
</tr>
<tr>
<td>90% of classes</td>
<td>2</td>
<td>1.5%</td>
<td>1.5%</td>
</tr>
<tr>
<td>100% of classes</td>
<td>0</td>
<td>0.0%</td>
<td>0.0%</td>
</tr>
<tr>
<td>Totals</td>
<td>130</td>
<td>100.0%</td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td></td>
<td>29.9%</td>
<td></td>
</tr>
<tr>
<td>Standard deviation</td>
<td></td>
<td>33.2</td>
<td></td>
</tr>
</tbody>
</table>

The dependent variable in the study was grade point average (GPA). GPAs were obtained from the registrar for both the fall of 2016 (GPA.fall2016) and for all undergraduate courses (GPA.overall). GPAs for fall 2016 ranged from 0.92 to 4.0 with a mean of 3.33, and a
standard deviation of 0.64. Overall GPAs ranged from 2.05 to 4.0 with a mean of 3.38, and a standard deviation of 0.51.

**Fall 2016 GPA regression results.** The SPSS analysis is included at Appendix D. All data were entered into SPSS and analyzed using multiple regression to determine the extent to which each independent variable contributes to GPA, and the extent to which the combined independent variables, or variate, contribute to GPA. Calculations were performed separately on fall 2016 and overall data.

For the fall of 2016, the adjusted R square indicated that the model explained 10.7% of the variability in GPA.fall2016. The F test was significant at $p=.001$ causing the researcher to reject the null hypothesis and find that the model does have significant predictive value.

The unstandardized and standardized coefficients for the fall of 2016 are given in Table 4.

<table>
<thead>
<tr>
<th></th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>1.793</td>
<td></td>
<td>.000</td>
</tr>
<tr>
<td>SRS Score</td>
<td>.007</td>
<td>.038</td>
<td>.644</td>
</tr>
<tr>
<td>NTM.fall2016</td>
<td>.010</td>
<td>.053</td>
<td>.534</td>
</tr>
<tr>
<td>ACT Composite</td>
<td>.051</td>
<td>.362</td>
<td>.000</td>
</tr>
</tbody>
</table>

The unstandardized regression equation is:

$$\text{GPA.fall2016}_{pred} = 1.793 + (.007)(\text{SRS}) + (.010)(\text{NTM.fall2016}) + (.051)(\text{ACT})$$

The standardized regression equation is:

$$\text{GPA.fall2016}_{pred} = (.038)(\text{SRS}) + (.053)(\text{NTM.fall2016}) + (.362)(\text{ACT})$$
Although the model itself has significant predictive value, a review of the significance of the individual coefficients indicated that only the ACT composite score is a significant \( (p = .001) \) independent variable. (For SRS Score, \( p = .644 \), and for NTM.fall2016, \( p = .534 \).) Therefore, the researcher cannot reject the null hypothesis which states that there is no significant relationship between grade point average for the fall of 2016 and the percentage of time taking notes during that semester using a keyboard versus by hand when ACT scores and self-regulation scores are held constant.

**Overall GPA regression results.** For GPA.overall, the adjusted R square indicated that the model explained 17\% of the variability in GPA.overall. The F test was significant at \( p = .000 \), causing us to reject the null hypothesis with regard to the predictability of the entire model.

The unstandardized and standardized coefficients for overall GPA and note taking method overall are given in Table 5.

<table>
<thead>
<tr>
<th>Coefficients – Overall</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>Significance</th>
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</thead>
<tbody>
<tr>
<td>Constant</td>
<td>1.916</td>
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<tr>
<td>SRS Score</td>
<td>.011</td>
<td>.073</td>
<td>.367</td>
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<tr>
<td>NTM.overall</td>
<td>-.005</td>
<td>-.029</td>
<td>.730</td>
</tr>
<tr>
<td>ACT Composite</td>
<td>.047</td>
<td>.422</td>
<td>.000</td>
</tr>
</tbody>
</table>

The unstandardized regression equation is:

\[
\text{GPA.overall}_{\text{pred}} = 1.916 + (.011)(\text{SRS}) - (.005)(\text{NTM.overall2016}) + (.047)(\text{ACT})
\]
The standardized regression equation is:

\[ \text{GPA.Overall}_{\text{pred}} = (0.073)(\text{SRS}) - (0.029)(\text{NTM.Overall2016}) + (0.422)(\text{ACT}) \]

Once again, although the model has significant predictive value, the predictive value comes from the only significant independent variable: the ACT composite score \( (p = .000) \). Neither SRS \( (p = .367) \) nor NTM.Overall \( (p = .730) \) were significant. Once again, we cannot reject the null hypothesis that states that there is no significant relationship between overall grade point average and percentage of time in all undergraduate classes spent taking notes using a keyboard versus by hand when ACT scores and self-regulation scores are held constant.

While the purpose of this study was to determine whether there is a significant relationship between note-method and grade point average, self-regulation was assumed to be a significant variable, as measures of content validity have indicated that SRS scores correlate with measures of generalized and academic self-efficacy (Diehl, Semegon, & Schwarzer, 2006). Therefore, the question of whether there is a significant relationship between GPA and NTM when controlling for ACT score and SRS score is based on an incorrect assumption that SRS scores contribute in a significant way to the variance in GPA.

**An unexpected finding.** A collateral, but totally unexpected, finding of this study is the separate relationship between ACT score and note-taking method. While reviewing the statistical output from SPSS concerning the primary hypothesis, it was noted that there is a correlation of -.257 between NTM.Overall and ACT composite score. Based on the strength of this relationship, a regression analysis was conducted using ACT composite score as the independent variable and NTM.Overall as the dependent variable. The null hypothesis here
would be that there is no relationship between ACT composite score and the method of taking notes.

The adjusted R square indicated that 5.9% of the variability in note-taking method would be explained by ACT score. (While this analysis could have placed either ACT composite or NTM.overall as the independent variable, it was decided to place ACT composite as the independent variable as it would appear to be more stable and less at the discretion of an individual student than the method by which a student decides to take notes.) The F test was significant at $p = .003$, and the unstandardized and standardized coefficients are presented in Table 6.

| Table 6 |
|---|---|---|---|
| **Coefficients** | **Unstandardized Coefficients** | **Standardized Coefficients** | **Significance** |
| Constant | 8.085 | | .000 |
| ACT Composite | -.154 | -.257 | .003 |

The unstandardized regression equation is:

$$\text{NTM.overall}_{pred} = 8.085 - (.154)(\text{ACT})$$

The standardized regression equation is:

$$\text{NTM.overall}_{pred} = (-.257)(\text{ACT})$$

Because the coefficient of the ACT composite score is negative, it indicates that, an increase in ACT score is related to a decrease in the use of a keyboard to take notes. This
finding requires a closer inspection of the ACT and what it purports to measure. While the publishers of the ACT say it is intended to measure achievement based on high school curriculum (The ACT Test for Students, 2017), it can also be used as a measure of general cognitive ability. When Koening, Frey, and Detterman (2008) compared the ACT with a variety of tests designed to measure intelligence, they found the ACT to be indistinguishable. If this is truly the case, then there may be a relationship between note taking by hand and intelligence which may explain some of the previous tests that have found a link between learning and note taking method (see Aguilar-Roca, Williams, & O’Dowd, 2015; Fried, 2008; Martin, 2011; and Mueller & Oppenheimer, 2014). Why students who are more intelligent (based on our traditional notions of I.Q.) may prefer taking notes by hand is a question that needs further exploration.

Limitations

This study relied on student self reports for important data points. Students were asked to estimate the percentage of classes in which they took notes using a keyboard for both the fall semester and their entire undergraduate career. Students may have had difficulty in remembering the degree to which they took notes on a laptop or on paper, and even if they remembered accurately, they may have had difficulty performing the task of converting that number to a percentage. On the other hand, students would be very unlikely to be totally off the mark when estimating the degree to which they have taken notes using a keyboard. In other
words, a student who brings a laptop to nearly every class and usually uses it for notetaking is highly unlikely to have estimated his or her NTM percentage at less than 50%. Nor would a student who rarely has a laptop in class likely to estimate his or her NTM percentage above 50%.

The fact that there was no relationship between SRS score and grade point average was surprising and disappointing. Our traditional beliefs concerning self-regulation links it to achievement, but then, the SRS is not only subjective, but relies on students to self report their beliefs about themselves. Students are asked to what degree a list of ten statements describe themselves and their responses may reflect a number of factors, such as how successful the student sees himself or herself in the moment or what positive or negative emotions that the student is currently experiencing. Or, although it seems intuitive that students with good self-regulation skills will spend more time studying and that will result in better grades, it may be that the idea that there is a strong correlation between self regulation and good grades is flawed.

While students were randomly selected to participate in the study, the sample may differ from the actual student population at the institution. For example, the mean ACT score for the students in the survey was 26.6, but for all sophomores, juniors and seniors at the institution, the mean is 24.29. Another issue is that students without ACT scores were excluded. These students may have something in common, such as all being international or transfer students. Additionally, the sample may be affected by self-selection bias: students who chose to participate and finish the survey may differ in some significant way from students who chose not to participate.
Finally, students were not asked a question that may have affected the outcome of the study: Were they in classes where the professor (or program) prohibited or required the use of a laptop?
CHAPTER 4
DISCUSSION

Note taking continues to be an important part of what it means to be a college student (Kauffman, Zhao, & Tang, 2011; Landrum, 2010; Piolat, Olive, & Kellogg, 2011). But research has not determined decisively whether students benefit from the act of taking notes (Barnett, Di Vesta, & Rogozinski, 1981; Di Vesta & Gray, 1972; Einstein, Morris, & Smith, 1985), or from the act of reviewing them (Eisner & Rohde, 1959; Kiewra et al., 1991; Kight & McKelvie, 1986; Palkovitz & Lore, 1980).

Studies have found that students experience a variety of problems when taking notes. Classroom notes are usually taken in time-pressured situations, and involve a variety of different mental processes, including making value judgments about material in the lecture and attempting to impose some form of organization on the notes themselves (Al-Musalli, 2015; Kiewra et al., 1991; Piolat, Olive, & Kellogg, 2005). Additionally, students in the classroom find themselves writing about what a professor said previously while the professor has already moved forward in the lecture.

While some teachers believe that the burden of taking good notes rests totally on the student, others have experimented with techniques designed to improve the quality of students’ notes. One technique is providing an outline of the lecture to students with key terms or phrases removed. This technique requires students to pay attention, while still providing them with a quality set of notes. A similar technique is to provide an outline of the lecture with spaces for the
student to fill in the details. Some professors provide power point slides to students to facilitate following the lecture, and some even provide the entire lecture written out. Unfortunately, these efforts have met with mixed results, with research indicating that some students stop paying attention all together when more of the material is provided to them (Stefanou, Hoffman, & Vielee, 2008; Williams, Weil, & Porter, 2012).

Advancements in technology have added an additional layer to the note taking conundrum: whether students benefit more from taking notes by hand or from taking notes using a keyboard as a part of some electronic device, such as a laptop. Some researchers have posited that, because taking notes on a keyboard is faster than by hand, students take verbatim notes when typing, resulting in more shallow mental processing of lecture material (Bui, Myerson, & Hale, 2013; Katayama, Shambaugh, & Doctor, 2005; Quade, 1996; Reimer, Brimhall, & O’Reilly, 2009).

Research indicates that students are increasingly bringing their laptops to class. Murray (2011) surveyed law students and found that 84% of them always brought their laptops to class. Annan-Coultas (2012) found that two-thirds of students attending a college for the health sciences believed that it was beneficial for them to have their laptops in the classroom. In this study, 73.8% of students responding reported that they preferred to take notes by hand, and only 27% reported taking notes on a keyboard in at least half of their classes.

A major downside to using laptops is their significant tendency to present students with irresistible distractions. Students who have laptops in class frequently engage in on-task activities such as reading and writing e-mails, instant messaging, playing games, surfing the

This study was designed to determine whether there was a significant relationship between note-taking method and grade point average when controlling for ACT score and self-regulation. Specifically, two time periods were studied: a single semester (the fall of 2016), and students’ entire undergraduate career. 130 students both responded in full to the survey sent out by e-mail and had available ACT scores. Only sophomores, juniors and seniors were asked to participate since freshman students would only have a single semester of course work completed at the time data was collected.

Students were asked their preferred form of note taking and, surprisingly, nearly three fourths of students reported that they preferred to take notes on paper. (This is consistent with the findings in a study by Annan-Coultas, 2012). An additional 24% of students reported preferring a laptop and 3% preferred taking notes on an electronic tablet. Although students overwhelmingly reported that they preferred to take notes on paper, 76% of students reported that they had taken notes on a laptop in at least 10% of their classes. It could be that some students, perhaps in business or another field, were actually required to use a laptop in class to take notes. However, this question was not asked.

The null hypothesis for this study was that there would be no significant relationship between grade point average and percentage of time taking notes using a keyboard versus by hand when ACT scores and self-regulation scores are held constant. The study was conducted using linear multiple regression on SPSS. For both the fall of 2016 and overall undergraduate
classes, the model was found to significantly predict grade point average, but a review of the significance of the coefficients for the independent variables indicated that this was because of the relationship between ACT score and grade point average. Note-taking method was not a significant factor in explaining the variability of grade point average.

A brief review of the correlations in this study indicated that there is a relationship between ACT score and note taking method, so a regression was run that indicated that this relationship was significant at $p = .003$. The relationship was determined to be negative, in that higher ACT scores were correlated with taking notes by hand rather than on a laptop. This relationship is interesting, particularly in light of the fact that ACT scores are highly correlated with grade point average while note taking method is not. While higher ACT scores are correlated with parental wealth and education, and therefore presumably access to technology, this finding is surprising and should be considered an area for future study.

While this study did not find a relationship between note-taking method and grade point average, either for a single semester or for students’ overall undergraduate career, some research has indicated that students learn more when they take notes by hand (Fried, 2008; Martin, 2011; Mueller & Oppenheimer, 2014). Other research has indicated that students learn better when taking notes on a laptop (Bui, Myerson, & Hale, 2013; Quade, 1996). A review of the literature did not reveal any study comparing the grade point averages of students who take notes by hand with those who take notes on laptops.

If we assume that students do perform better on higher level thinking questions when they take notes by hand, then how can we explain that there is no statistical difference in grade
point average between students who take notes by hand and those who enter their notes using a keyboard? Perhaps the answer lies in the way undergraduate students are being tested: Students may be tested in their classes using questions that measure lower level thinking skills.

The theory that questions can be structured in a way to require students to process information at a deeper level began with Bloom (1956) (cited in Adams, 2015). Bloom’s taxonomy categorizes learning into six levels. The level at which students process material is related to what they are asked to do with information. Level 1 is the knowledge level. At this level students are required to remember and recite facts. Level 2 requires comprehension. Here students must relate new learning to previous learning, perhaps by paraphrasing, classifying, or making comparisons. Application, Level 3, is using information to solve a particular problem, or applying facts to a particular situation. Level 4 is analysis, or critically thinking about the way granular information relates to the whole. Students engaging in analysis might be asked to break down an argument into its component parts. Synthesis, level 5, is putting disparate information together to form something new and original, be it an essay, argument, or a new work or art. And finally, evaluation, level 6, is making value judgements about information and about situations where that information is applied (Duron, Limbach, & Waugh, 2006).

If Mueller & Oppenheimer’s experiment results are generalizable, and students taking notes by hand only outperform those taking notes using a keyboard when asked to perform higher level thinking tasks, perhaps most of the undergraduate students participating in this study are only being asked to perform knowledge and comprehension tasks. Zheng, et al. (2008) looked at questions on undergraduate biology tests (at a different undergraduate institution) and
found there was significant differences in the level of questions asked on exams. While some professors gave their students questions that required application of knowledge, critical thinking and analysis, some professors only tested students on their memorization of information. Momsen, et al. (2010) found that in an introductory biology class, 93% of test questions were basic knowledge or comprehension questions, the two lowest levels of Bloom’s taxonomy. If note taking method on a college’s campus is not correlating with grade point averages, the fault may not be with the theory so much as with the way students are being taught and tested: If we are not asking our students to process material at the higher level of Bloom’s taxonomy, then note taking method may be irrelevant.

This, of course, presumes that our students need to learn to think at the higher levels of Bloom’s taxonomy, not only memorizing information, but also analyzing it, synthesizing ideas, and making evaluative judgments. Whether individual faculty members would agree with this is beyond the scope of this study. Whether individual faculty members know how to structure learning so that students achieve higher levels of thinking is also a question that cannot be answered here.

This study suffers from some limitations. First of all, self reports were relied on for the percentage of classes in which students take notes on a keyboard. Students may have difficulty in remembering the extent to which they have taken notes on a laptop versus on paper. Students may also have difficulty converting this proportion to a percentage. The SRS also requires students to self report. This may partially explain why no relationship was found between SRS scores and grade point averages. This study relied on student self reports for important data.
points. Students were asked to estimate the percentage of classes in which they took notes using a keyboard for both the fall semester and their entire undergraduate career. Students may have had difficulty in remembering the degree to which they took notes on a laptop or on paper, and even if they remembered accurately, they may have had difficulty performing the task of converting that number to a percentage. On the other hand, students would be very unlikely to be totally off the mark when estimating the degree to which they have taken notes using a keyboard. In other words, a student who brings a laptop to nearly every class and usually uses it for notetaking is highly unlikely to have estimated his or her NTM percentage at less than 50%. Nor would a student who rarely has a laptop in class likely to estimate his or her NTM percentage above 50%. Furthermore, the fact that the curve for responses to the NTM.overall question is more narrow than that for the NTM.fall 2016 question lends credence to the fact that students were responding to the questions thoughtfully.

The fact that there was no relationship between SRS score and grade point average was surprising and disappointing. Our traditional beliefs concerning self-regulation links it to achievement, but then the SRS is not only subjective, but relies on students to self-report their beliefs about themselves. Students are asked to what degree a list of ten statements describe themselves and their responses may reflect a number of factors, such as how successful the student sees himself or herself in the moment or what positive or negative emotions that the student is currently experiencing. Or, although it seems intuitive that students with good self-regulation skills will spend more time studying and that will result in better grades, it may be that the idea that there is a strong correlation between self-regulation and good grades is flawed.
Regardless, a review of the responses for individual students reveals a consistency that indicates that students were actually reading the questions in the SRS and responding thoughtfully.

While students were chosen randomly to receive the e-mail inviting them to participate in the study, only a fraction actually took part. This self-selection among participants may mean that the students who completed the study differ in some significant way from the students who chose not to participate.

Another limitation is that the students participating in the study may differ significantly from the university’s entire student body. The mean ACT score for the student body (sophomores, juniors and seniors) is 24.29, while the mean for the study was 26.6, over two points higher. Furthermore, students without ACT scores were excluded from the study. These students may have represented the international student and transfer student populations, important sectors of the university computer. Since the study found a negative relationship between laptop use and ACT score, these potential differences in the population and the sample might be worth exploring in the future.

Finally, the students should have been asked whether any of their professors required or prohibited the use of laptops in the classroom. If professors are insisting that students use (or not use) laptops in class, this factor may have had an impact on the study.
CHAPTER 5
CONCLUSION

While in some areas of study, faculty members may begin teaching with more interactive methods, we can assume that note taking will continue to be an important element of classroom learning (Kauffman, Zhao, & Tang, 2011; Landrum, 2010; Piolat, Olive, & Kellogg, 2011). This remains true even though research has not clearly revealed how students benefit from taking notes: Do students learn from taking them (Barnett, Di Vesta, & Rogozinski, 1981; Di Vesta & Gray, 1972; Einstein, Morris, & Smith, 1985), or reviewing them (Eisner & Rohde, 1959; Kiewra et al., 1991; Kight & McKelvie, 1986; Palkovitz & Lore, 1980)?

Research does indicate that certain student struggle when taking notes. Notes are often taken under extreme time constraints requiring students to listen to a lecture while having to make judgments about the relative importance about the concepts being presented. Students also struggle with imposing some type of organization on their notes, and some end up with no organization at all (Al-Musalli, 2015; Kiewra et al., 1991; Piolat, Olive, & Kellogg, 2005). Some creative instructors attempt to help students take notes by providing outlines, or even copies of the lecture with key terms omitted (for students to fill in during class). Others who lecture from power point provide students with copies of the slides. All these techniques focus on helping students create a better set of notes, although giving students too much help can result in them having no reason to pay attention to the lecture itself (Stefanou, Hoffman, & Vielee, 2008; Williams, Weil, & Porter, 2012).
Students now bring laptops to class in increasing numbers, and some classes even require students to have a laptop. This advancement in technology has raised additional questions, including whether students learn more or less when typing rather than writing by hand. One school of thought is that students can type faster than they can write; therefore, they end up typing the lecture verbatim. Typing the lecture word for word means that students do not have to make value judgments about the information in the lecture – they just default to autopilot (Bui, Myerson, & Hale, 2013; Katayama, Shambaugh, & Doctor, 2005; Quade, 1996; Reimer, Brimhall, & O’Reilly, 2009).

Laptops present students with all kinds of distractions. Having a laptop in class means that a student must choose between reading e-mails, instant messaging, surfing the web, playing games, shopping online, or listening to the lecture. Listening to the lecture can suddenly be much less inviting. (Fried, 2008; Kay & Lauricella, 2011; Kraushaar & Noval, 2010; Ragan, Jennings, Massey, & Doolittle, 2013).

While some studies have indicated that the majority of students now bring a laptop to class (Annan-Coultas, 2012, and Murray, 2011), surprisingly, 74% of the students surveyed here indicated that they preferred to take notes on paper, and only 27% reported using a laptop in half their classes.

The focus of this study was to determine whether there is a relationship between note taking method (taking notes on a laptop or by hand) and grade point average. Composite ACT score and the student’s score on the Self Regulation Survey (SRS) were controlling independent variables. (The SRS, although having been tested for validity and reliability (Diehl, Semegon, &
Schwarzer, 2006), performed very poorly in this study showing no correlation with grade point average and, therefore, yielding no helpful information.) After obtaining permission from the Institutional Review Board, 130 sophomores, juniors and seniors at a midsized research university in the south participated and a multiple regression was performed for grades and note-taking method for both the fall 2016 semester and for all classes students had taken as an undergraduate.

To determine note taking method, students were asked to estimate the percentage of classes in which they had taken notes using a keyboard. They were also asked to answer the ten questions comprising the SRS. Grade point averages and ACT scores were obtained from the institution’s databases with permission of the participants.

The null hypothesis for this study was that there would be no significant relationship between grade point average and percentage of time taking notes using a keyboard versus by hand when ACT scores and self-regulation scores are held constant. Although the overall model significantly predicted grade point average for both the fall 2016 semester and for students’ overall GPA, this was because of the inclusion of ACT score as an independent variable. Note taking was not found to be a significant predictor of GPA.

This finding appears to contradict other studies which indicate that students learn more when taking notes by hand (Fried, 2008; Martin, 2011; Mueller & Oppenheimer, 2014). These other studies indicate that this improvement of learning only manifests itself when students are tested on levels of thinking commensurate with the higher levels of Bloom’s taxonomy. One way to reconcile this seeming contradiction is to extrapolate that students at this institution may
not be tested using higher level thinking skills. In other words, faculty members may rely primarily on questions that measure rote memorization rather than requiring students to analyze, synthesize and evaluate information.

A surprising finding in this study was a correlation between composite ACT score and note taking method. This relationship was found to be significant at $p = .003$. Because the relationship is negative, results indicate that higher composite ACT scores are related to taking notes by hand rather than on a keyboard. This particular finding raises new questions for further research.


Proceedings of Selected Research and Development Presentations at the 1996 National Convention of the Association for Educational Communications and Technology, 559-570. (ED397825)


APPENDIX A
APPLICATION TO CONDUCT RESEARCH WITH HUMAN SUBJECTS

~ Instructions ~

- Use the most recent version of this form ([research.olemiss.edu/irb/protocol](http://research.olemiss.edu/irb/protocol)).
- Do not submit a handwritten form. Prepare as a Word document. [Note that, as this is a protected form, you cannot use Spell Check. It is best to prepare text in another document first, then cut and paste.]
- Answer all of the questions on this form completely. (If you have questions about this form, please contact the DRIC office at 662-915-7482 or [irb@olemiss.edu](mailto:irb@olemiss.edu).)
- For examples of materials go to [http://www.research.olemiss.edu/irb-forms](http://www.research.olemiss.edu/irb-forms)
- Complete and attach all supporting documentation and all appropriate appendices.
- Incomplete submissions will not be reviewed.
- E-mail the completed form in [Microsoft Word](http://www.microsoft.com) format with attachments to [irb@olemiss.edu](mailto:irb@olemiss.edu). Email the signature page as [PDF](http://www.adobe.com), fax to 662-915-7577, or mail or bring it to the Office of Research and Sponsored Programs, Division of Research Integrity and Compliance, 100 Barr Hall, University, MS 38677.

List all personnel involved with this research who will have contact with human subjects or with their identifiable data.

All personnel listed here must complete [CITI training](http://www.citi.org) before this application will be processed.

If more space is needed to list project personnel, please submit [Appendix A](http://www.olemiss.edu).
### UM Personnel

<table>
<thead>
<tr>
<th>NAME (and email)</th>
<th>FACULTY OR STAFF</th>
<th>GRADUATE STUDENT</th>
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<th>ROLE ON PROJECT</th>
<th>IRB Training Approval</th>
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<tr>
<td>Donna Gurley (<a href="mailto:dgurley@olemiss.edu">dgurley@olemiss.edu</a>)</td>
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**IRB Training Approval**
- Check ‘yes’ ONLY if they have current approval (completed CITI training within the last 3 years)

### Non-UM Personnel (including UMMC)

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*Only needed if ‘key’ personnel, (i.e., research staff responsible for the design of the study and all those who come in contact with human participants and/or identifiable data)
# APPLICATION TO CONDUCT RESEARCH WITH HUMAN SUBJECTS

## 1. PROJECT TITLE:
The Relationship Between Grade Point Average and Note Taking Method for Undergraduate College Students

## 2. PRINCIPAL INVESTIGATOR:

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<tr>
<td>Dr.</td>
<td>Ms.</td>
<td>Mr.</td>
<td>Donna L. Gurley</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Department: Leadership and Counselor Education</td>
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<tr>
<td></td>
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<td>Work Phone: <strong>662-915-7014</strong></td>
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<tr>
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<td>Home or Cell Phone: <strong>662-816-4722</strong></td>
</tr>
<tr>
<td>E-Mail Address:</td>
<td><a href="mailto:dgurley@olemiss.edu">dgurley@olemiss.edu</a></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

If Principal Investigator is a student:

<table>
<thead>
<tr>
<th>Graduate student:</th>
<th>Undergraduate student:</th>
</tr>
</thead>
<tbody>
<tr>
<td>☑ Dissertation</td>
<td>☑ Master’s</td>
</tr>
<tr>
<td>thesis</td>
<td>☐ Senior thesis:</td>
</tr>
<tr>
<td></td>
<td>☐ SMBHC</td>
</tr>
<tr>
<td></td>
<td>☐ Croft Institute</td>
</tr>
<tr>
<td></td>
<td>☐ Other graduate project</td>
</tr>
<tr>
<td></td>
<td>☐ Other Other project</td>
</tr>
</tbody>
</table>

### RESEARCH ADVISOR:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Kerry B. Melear</td>
<td>Not applicable</td>
</tr>
<tr>
<td>(required for student researchers)</td>
<td></td>
</tr>
<tr>
<td>Department: Leadership and Counselor Education</td>
<td>Work Phone: <strong>915-5016</strong></td>
</tr>
<tr>
<td>E-Mail Address: <a href="mailto:kbm@olemiss.edu">kbm@olemiss.edu</a></td>
<td>Home or Cell Phone: <strong>662-801-2839</strong></td>
</tr>
</tbody>
</table>
3. **Funding Source:**

   Is there funding for this project? [ ] Yes, is the funding:

   - [ ] Internal: [ ] Source:
   - [x] External: [ ] Agency:

   No [ ] Pending [ ] Awarded

   PI on external funding:

4. **Anticipated Beginning and Ending Dates of Human Subjects Contact:**

   Beginning Date: 11/07/2016
   Ending Date: 02/01/2016

   Not Applicable: [ ]

**Research Methodology/Procedures**

5. **Check all procedures below that apply to your study:**

   Source of data: Data will be pulled by Institutional Research from the Office of the Registrar. The researcher will not have access to identifiers.

   - [x] Pre-existing data
   - Do data have identifiers? [ ] Yes* [x] No

   *if health information, you may need to fill out Appendix F

   - [ ] Observation
   - [ ] Oral history
   - [ ] Interview
Anonymous or Confidential?

Anonymous means (1) the investigator cannot associate a subject with his/her data and (2) the data cannot identify a subject. Examples: Surveys with no names handed to an investigator are not anonymous; surveys placed by the subject in a group data envelope can be anonymous; surveys with no names and with demographic data that can identify a subject (e.g., the only African-American in a class) are not anonymous, interviews, by definition, are NOT anonymous.
- Collection of college student grades, ACT scores, etc. from colleague’s class or from Registrar

See [FERPA-covered records release policy](#) for more information.

- □ Videotaping

Use and attach a [release form](#) if you plan to disseminate quoted comments or taped content (This covers you and UM legally – Not for IRB purposes)

- □ Audio recording

- □ X-rays

E.g. DEXA ~ contact [Health & Safety](#) for training requirements.

- □ Collection/use of blood, urine, other bodily fluids, or tissues **

Has IBC application been submitted? □ Yes □ No
If Yes, has IBC application been approved? □ Yes □ No

** May require IBC approval; see [research.olemiss.edu/health-safety/ibc](#) for more information.

Contact [Health and Safety](#) for training requirements.

- □ Use of drugs, biological products, or medical devices
6. **Deception or Omission of Elements of Consent:**
   Do any of the following apply to your study? ☒ No

- ☐ The study uses surreptitious videotaping.
- ☐ The study gives subjects deceptive feedback, whether positive or negative.
- ☐ The study uses a research confederate.
- ☐ The study has misleading or deceptive:
  1. study descriptions; 2. procedure explanations; and/or 3. survey instructions/rationales.

If you checked any of the above, please complete Appendix D.

---

**Participant Information**

7. **Subject Characteristics:**
   Number: I hope that 200 individuals participate.
   Age Range: 18-30

   If under 18, parental consent is required.

- ☐ Checkbox on Consent Form
- ☒ Other: IR will be asked to exclude anyone under 18 from the panel.
- ☐ Not applicable

8. **Briefly Describe Subject Population:**
   On campus, full-time, undergraduate students who are sophomores, juniors and seniors

   E.g. 2nd grade students, college students, etc. Justify exclusion of any racial or gender group.
9. **Potentially Vulnerable Subjects Targeted:**

- [ ] Children/adolescents\(^1\)
- [ ] Mentally ill – outpatients
- [ ] Mentally ill – inpatients
- [ ] Cognitively impaired
- [ ] Elderly, if institutionalized
- [ ] Pregnant females
- [ ] Prisoners\(^2\)
- [ ] HIV+
- [ ] Other:
  - [ ] Not applicable

Check all applicable groups.  
\(^1\) Complete Appendix B if applicable.  
\(^2\) Complete Appendix C.

10. **Recruitment Procedures:**

a. How will you recruit subjects? Check all that apply:

- [ ] Sona System
- [ ] UM bulletin boards, where:
  - [ ] Class announcements
  - [ ] Letters to parents/guardians
  - [ ] E-mail – specify groups: [E-mail to random sophomores, juniors and seniors]
- [ ] Radio/TV/newspaper ads
- [ ] Other:
  - [ ] [List all recruitment sites.]

b. Are subjects in a subservient power relationship to investigators or to parties with an interest in the research, such as students in an instructor/investigator’s class or employees of the investigator?

- [ ] Yes
- [ ] No
If Yes, how will you ensure that their participation is truly voluntary?

Recruitment ad/e-mail/oral announcement is attached:

☐ Yes  ☐ No  ☐ Not applicable

[Recruitment materials must state “This study has been approved by UM’s Institutional Review Board (IRB). Ensure subject inclusion/exclusion criteria matches what will be used for the study.”]

c. Describe incentives for subjects, if any (money, drawing, class points*, etc.).

☐ No incentives

Students who complete the consent form will be entered for a drawing. 100 students will receive $10 each.

*If class points, there must also be alternative assignments for earning points, involving comparable time and effort.

d. List pro-rating for incentives for study drop-outs.

☐ Not applicable

Individuals who begin the survey but drop out will be included in the drawing.
11. **CONSENT PROCEDURES***:

- [ ] Oral (attach script)
- [ ] Information letter – used in survey research (attach)
- [x] Informed consent form (attach)
- [ ] Assent form for children or subjects with intellectual disabilities (attach)
- [ ] Not applicable – Explain:

- [x] Request waiver of *written* consent – justify: **Pursuant to current university practices, students receiving the recruitment e-mail will be instructed that, by clicking on the "consent to participate" link, they are agreeing to participate in the survey AND agreeing to have their educational records accessed. The e-mail (attached) will specify the information being accessed.**

- [ ] Request waiver of consent – justify:

*See examples and templates here*
12. **WHERE WILL THE STUDY BE CONDUCTED?**

<table>
<thead>
<tr>
<th>Option</th>
</tr>
</thead>
<tbody>
<tr>
<td>☑ UM campus</td>
</tr>
<tr>
<td>☐ Local community: elementary/secondary school(s) or child care facility¹</td>
</tr>
<tr>
<td>☐ Local community: other – specify:</td>
</tr>
<tr>
<td>☐ Another U.S. location – specify:</td>
</tr>
<tr>
<td>☐ Another country² – specify:</td>
</tr>
</tbody>
</table>

B. **HAVE YOU OBTAINED PERMISSION?**

<table>
<thead>
<tr>
<th>Option</th>
</tr>
</thead>
<tbody>
<tr>
<td>☑ Approval letter attached</td>
</tr>
<tr>
<td>☑ Not applicable – Explain: Approval by my committee has been granted and I am waiting on IRB approval.</td>
</tr>
</tbody>
</table>

1³Complete Appendix B.

2²Complete Appendix E.

---

13. **DESCRIBE ALL POSSIBLE RISKS TO SUBJECTS.**

**LIST STEPS TO MINIMIZE RISKS, INCLUDING EXPERIMENTER AND RESEARCH ASSISTANT TRAINING/EXPERTISE.** For example, an emergency plan to handle potential adverse events for traumatic experience surveys or psychology research with children.

a. **Physical:** ☑ n/a

b. **Emotional:** Students will be asked to complete a 10 question survey concerning their ability to self-evaluate. Students will be informed about this part of the survey prior to participating and will also be ☑ n/a
regulate. Students may initially be able to stop participation if they find the surprised if the survey indicates to questionnaire disturbing.

them that they have trouble in controlling their current behavior to reach a future goal.

c. Social/interpersonal: n/a
d. Occupational: n/a
e. Financial: n/a
f. Legal: n/a
g. Other: n/a

14. WHAT ARE THE POTENTIAL BENEFITS, IF ANY, TO SUBJECTS (e.g. recognition of health risks, reduced stress, increased physical fitness, etc.) POTENTIAL BENEFITS DO NOT INCLUDE INCENTIVES OFFERED FOR PARTICIPATION.

Students will be asked to complete a 10 question survey concerning their ability to self-regulate.

Students may benefit from this self assessment and look for future opportunities to regulate current behavior to reach future goals.

15. HOW WILL YOU MAINTAIN DATA CONFIDENTIALITY?

☒ All data are anonymous (go to next section).
☐ Data are confidential.
☐ Data kept in locked file cabinets.
☐ Data kept in locked room.

When will data be de-identified? Data will be deidentified by Institutional Research before

Anonymous or Confidential?

Anonymous means (1) the investigator cannot associate a subject with his/her data and (2) the data cannot identify a subject.

THE IRB ENCOURAGES PERMANENT RETENTION OF DATA FOR POTENTIAL FUTURE USE BECAUSE THIS IMPROVES THE COST/BENEFIT RATIO.
being provided to the researcher. At no time will
the researcher have access to identifying
information for participants. □ n/a

IRB recommends that investigators physically separate sensitive data from identifiers. Here is a method that separates
data from identifiers across 2 devices and greatly reduces breach of confidentiality risks:

1. Record data on one storage device
2. Add a code number to each subject
3. Copy the code and move the identifying data to a separate device

---

**PROJECT DESCRIPTION**

**16. Describe your project in the spaces below.**

**a. Problem statement (including specific aims of your project):**

This study is designed to determine whether there is a relationship between grade point average and whether an individual takes notes on a laptop or takes notes by hand. The study will also consider the extent that self control and ACT scores contribute to any such relationship

**b. Brief literature review that points to a need for this research (including references):**

No one can doubt the importance of note taking for college students (Crawford, 1925a; Kauffman, Zhao, & Tang, 2011; Landrum, 2010; Piolat, Olive, & Kellogg, 2011). Studies about the value of note taking date back to 1925 when Crawford (1925b) found that students perform best on exams when they are allowed to both take notes and review those notes. Other than studies by McClendon (1958) and Eisner & Rohde (1959), there was limited interest in note taking
research until the 1970s. In an important study in 1972, Di Vesta & Gray found that students benefitted from the actual act of taking notes and that they performed even better when they were allowed to review those notes immediately after a lecture.

A great deal of interest has focused on whether students benefit from the encoding aspect of note taking – in other words from the actual act of taking notes in class (Barnett, Di Vesta, & Rogozinski, 1981; Di Vesta & Gray, 1972; Einstein, Morris, & Smith, 1985) – or from reviewing those notes (Eisner & Rohde, 1959; Kiewra et al., 1991; Knight & McKelvie, 1986; Palkovitz & Lore, 1980). Other research has looked at the difficulties that students experience in taking notes (Al Musalli, 2015; Bohay, Blakely, Tamplin, & Radvansky, 2011; Kiewra, 1991; Peverly, Ramaswamy, Brown, Sumowski, & Alidoost, 2007; Piolat, Olive, & Kellogg, 2005; Stefanou, Hoffman, & Vielee, 2008; Titsworth, 2004; van der Meer, 2012; Williams, Weil, & Porter, 2012).

As early as the 1990s, researchers have noted the growing use of laptops to take notes in the classroom (Kalbers & Rosner, 2003), and other researchers have found more and more students bringing laptops to class (Davison & Lazaros, 2015; Kay & Lauricella, 2011; Kobus, Rietveld, & van Ommeren, 2013). However, many scholars have questioned whether the tendency of students to take verbatim notes results in mental processing that is more shallow and, therefore, results in less learning (Bui, Myerson, & Hale, 2013; Katayama, Shambaugh, & Doctor, 2005; Quade, 1996; Reimer, Brimhall, & O’Reilly, 2009).

A major problem with laptops is the tendency of students to become distracted, both by applications on their own laptop and by seeing the screens of the laptops around them (Aguilar-Roca, Williams, & O’Dowd, 2015; Annan-Coultas, 2012; Barry, Murphy, & Drew, 2015; Carstens, Watson & Williams, 2015; Fried, 2008; Gupta & Irwin, 2016; Hembrooke & Gaye, 2003; Kay & Lauricella, 2011; Kim, Turner, & Pérez-Quiñones, 2009; Kraushaar & Novak, 2010; McDonald, 2012; Ragan, Jennings, Massey, & Doolittle, 2013).
In a much publicized study, Mueller & Oppenheimer (2014) found that students performed better on tests involving higher level thinking tasks when they had taken notes by hand. Aguilar-Roca, Williams, & O’Dowd (2012) also found that students performed better in a college biology class when taking notes by hand and Martin, 2011, determined that students in a traditional classroom outperformed students in a computer lab even though the course was in business statistics and students in the class had access to Excel.

However, Quade (1996) found that students who took notes on a laptop outperformed students taking notes by hand when asked factual questions. Bui, Myerson, & Hale (2013) also conducted an experiment in which students taking notes on a laptop outperformed those taking notes by hand.

References


Barry, S., Murphy, K., & Drew, S. (2015). From deconstructive misalignment to constructive alignment: Exploring student uses of mobile techn


Gupta, N. & Irwin, J. D. (2016). In-class distractions: The role of Facebook and the primary learning task. Computers in Human Behavior, 55, 1165-1178. doi:10.1016/j.chb.2014.10.022


c. Description of procedures:

Participants will be asked to complete a survey concerning their note taking habits that will indicate the percentage of notes that they take using a keyboard as opposed to writing by hand. A second part of the survey will be the SRS, a ten item measure of self-regulation behaviors. Students will give access to demographic data, to their grade point averages (overall and for the previous semester), and to their ACT scores. Data will be analyzed by multiple regression. Note taking method, ACT score, and SRS scores will be independent variables and grade point average will be the dependent variable. The objective is to determine whether there is a relationship between note taking method and grade point average when holding ACT scores and self-regulation abilities constant.

Measures: (attach all measures – with labels that correspond to your list below)

<table>
<thead>
<tr>
<th>Survey/Test/Questionnaire (e.g. WAIS)</th>
<th>Is there published psychometric support?</th>
</tr>
</thead>
<tbody>
<tr>
<td>NAME AND ACRONYM</td>
<td></td>
</tr>
<tr>
<td>1 SRS -- Self Regulation Survey</td>
<td>☑ Yes</td>
</tr>
</tbody>
</table>
e. Provide a numbered step-by-step list of all procedures from the point of view of the subjects, starting with recruitment. Include when consent will be obtained and from whom. Elaborate on more complex items. Attach scripts of procedural instructions to subjects. For examples, click here to visit the ORSP website.

1 Participants will receive an e-mail asking them if they wish to participate in a study concerning the relationship between note-taking method and grade point average. They will be informed that, should they proceed by clicking on the link in the e-mail, they are consenting to both participating in the research (by filling out a survey) and allowing Institutional Research to match overall GPA, GPA from the previous semester, ACT score
and other demographic information to their responses on the survey. They will be informed that the researcher will have no knowledge of how individuals responded or whose demographic data is matched to an individual's survey results. They will be reminded that they can exit the survey any time. They will also be informed that, by moving forward, they will be entered in a drawing for one of 100 ten dollar prizes.

2 Participants who click on the consent button will be directed to a Qualtrics survey. The survey will begin with a statement about the purpose of the research and a reminder that students can quit any time during the survey. The first part of the survey is a series of questions about note taking habits. These questions are followed by the Self Regulation Survey which is a series of ten questions concerning

3 The instrument will take approximately 15 minutes to complete. At the end, students will be thanked for their participation. Students will be informed about how to obtain counseling services if they so choose. There will also be a statement about being informed at a later date if they won $10 in the drawing.

4

5

f. Data analysis methods:

Data will be analyzed by multiple regression. Note taking method, ACT score, and SRS score will be the independent variables and grade point average will be the dependent variable.

g. Debriefing and/or feedback on test results (procedures, forms, scripts, and statements):

☐ Not applicable  Students will not be debriefed.
17. Appendix Checklist:

A. Additional Personnel not listed on first page of application?
   ☒ No  ☐ Yes – complete Appendix A

B. Will the research be conducted in schools or child care facilities?
   ☒ No  ☐ Yes – complete Appendix B

C. Will any of your subjects be prisoners?
   ☒ No  ☐ Yes – complete Appendix C

D. Does your research involve deception or omission of elements of consent?
   ☒ No  ☐ Yes – complete Appendix D

E. Will your research be conducted outside of the United States?
   ☒ No  ☐ Yes – complete Appendix E

F. Will your research involve protected health information?
   ☒ No  ☐ Yes – complete Appendix F

18. Attachments Checklist:
Did you submit:

a. survey or questionnaires?
   ☒ Yes ☐ Not Applicable

b. interview questions?
   ☐ Yes ☒ Not Applicable

c. recruitment email, announcement, or script?
   ☒ Yes ☐ Not Applicable

d. Informed consent form?
   ☒ Yes ☐ Not Applicable

19. If using class points as incentives, are there alternative assignments available for earning points that involve comparable time and effort?
   ☐ Yes ☒ Not Applicable

*Please note that the required abstract/project summary is located after the signature sections.*
Do you or any person responsible for the design, conduct, or reporting of this study have an economic interest in, or act as an officer or a director of any outside entity whose financial interests may reasonably appear to be affected by this research?

☐ YES  ☐ ☐ ☐ If Yes, please explain any potential conflict of interest.
☒ NO

Do you or any person responsible for this study have existing financial holdings or relationships with the sponsor of this study?

☐ YES  ☐ ☐ ☐ If Yes, please explain any potential conflict of interest.
☐ NO
☒ N/A

**SIGNATURES**

**PRINCIPAL INVESTIGATOR AND RESEARCH ADVISOR (IF APPLICABLE) MUST SIGN BELOW**

**Principal Investigator’s Assurance**

I certify that the information provided in the application is complete and correct. As Principal Investigator, I have the ultimate responsibility for the protection of the rights and welfare of the human participants, conduct of the research, and the ethical performance of the project. I will comply with all UM policies and procedures, as well as with all applicable federal, state, and local laws.
regarding the protection of participants in human research, including, but not limited to the following:

- The research will be performed by qualified personnel according to the approved research protocol;
- No changes will be made in the research protocol or informed consent document(s) until approved by the IRB;
- Informed consent will be obtained from the participants, if applicable and appropriate;
- Adverse events and/or unanticipated problems will be reported to the IRB as required.

I certify that I, and all key personnel, have completed the required initial and/or refresher CITI courses in the ethical principles and regulatory requirements for the protection of human research participants.

__________________________
Signature of Principal Investigator

__________________________
Date

**Research Advisor’s Assurance (Required for Student Projects)**

As the research advisor, I certify that the student investigator is knowledgeable about the regulations and policies governing research with human participants and has sufficient training and experience to conduct this particular research in accordance with the approved protocol.

- I agree to meet with the investigator on a regular basis to monitor research progress;
- Should problems arise during the course of the research, I agree to be available, personally, to supervise the investigator in solving them;
- I will ensure that the investigator will promptly report adverse events and/or unanticipated problems to the IRB as required;
- If I will be unavailable, for example, on sabbatical leave or vacation, I will arrange for an alternate faculty member to assume responsibility during my absence and I will advise the IRB by letter or e-mail of such arrangements; and
• I have completed the required initial and/or refresher CITI courses in the ethical principles and regulatory requirements for the protection of human research participants.

________________________________________

Signature of Research Advisor*                Date

*The research advisor must be a UM faculty member. The faculty member is considered the responsible party for the ethical performance and regulatory compliance of the research project.
ABSTRACT: Briefly summarize your project using non-technical, jargon-free language that can be understood by non-scientists. Include: (1) a statement of the research question and related theory supporting the reasons for, and importance of, the research; (2) the ages and characteristics of your proposed subjects and how you will recruit them; (3) the research design; and (4) a description of the procedure(s) subjects will undergo. Limit to the space below. For examples, click here to visit the ORSP website.

This study will examine whether there is a relationship between the way students take notes (either by handwriting or on a keyboard) and grade point average. Although no one has looked at this relationship, there have been studies that compared students' performance (under experimental conditions) on tests after taking notes either by hand or on a laptop. These studies have had mixed results. This study will look at the grade point averages of students and examine whether there is a relationship with note taking method when ACT scores and the ability to self regulate are held constant. Multiple regression will be used to determine whether such a relationship exists.
As department chair, I acknowledge that the above described research is in keeping with the standards set by our department and I certify that the Principal Investigator has met all departmental requirements for approval of this research.

________________________________________

Signature of Department Chair/Dean*

Date

*If the Principal Investigator is also the department chair, this signature must be that of the Dean.
ASSURANCES ~ CONFLICT OF INTEREST AND FISCAL RESPONSIBILITY

Do you or any person responsible for the design, conduct, or reporting of this study have an economic interest in, or act as an officer or a director of any outside entity whose financial interests may reasonably appear to be affected by this research?

☐ YES  ☑ NO

If Yes, please explain any potential conflict of interest.

Do you or any person responsible for this study have existing financial holdings or relationships with the sponsor of this study?

☐ YES  ☑ NO

☐ N/A

If Yes, please explain any potential conflict of interest.

SIGNATURES

PRINCIPAL INVESTIGATOR AND RESEARCH ADVISOR (IF APPLICABLE) MUST SIGN BELOW

PRINCIPAL INVESTIGATOR’S ASSURANCE

I certify that the information provided in the application is complete and correct. As Principal Investigator, I have the ultimate responsibility for the protection of the rights and welfare of the human participants, conduct of the research, and the ethical performance of the project. I will comply with all UM policies and procedures, as well as with all applicable federal, state, and local laws regarding the protection of participants in human research, including, but not limited to the following:

• The research will be performed by qualified personnel according to the approved research protocol;
• No changes will be made in the research protocol or informed consent document(s) until approved by the IRB;
• Informed consent will be obtained from the participants, if applicable and appropriate;
• Adverse events and/or unanticipated problems will be reported to the IRB as required.

I certify that I, and all key personnel, have completed the required initial and/or refresher CITI courses in the ethical principles and regulatory requirements for the protection of human research participants.

[Signature of Principal Investigator]  [Date]

RESEARCH ADVISOR’S ASSURANCE (REQUIRED FOR STUDENT PROJECTS)

As the research advisor, I certify that the student investigator is knowledgeable about the regulations and policies governing research with human participants and has sufficient training and experience to conduct this particular research in accordance with the approved protocol.

• I agree to meet with the investigator on a regular basis to monitor research progress;
• Should problems arise during the course of the research, I agree to be available, personally, to supervise the investigator in solving them;
• I will ensure that the investigator will promptly report adverse events and/or unanticipated problems to the IRB as required;
• If I will be unavailable, for example, on sabbatical leave or vacation, I will arrange for an alternate faculty member to assume responsibility during my absence and I will advise the IRB by letter or e-mail of such arrangements; and
• I have completed the required initial and/or refresher CITI courses in the ethical principles and regulatory requirements for the protection of human research participants.

[Signature of Research Advisor]  [Date]

*The research advisor must be a UM faculty member. The faculty member is considered the responsible party for the ethical performance and regulatory compliance of the research project.

IRB Application to Conduct Research with Human Subjects (rev. 08/2015) – page 11
APPENDIX B
Survey of Note-Taking Habits

Donna Gurley <noreply@qemailserver.com>

Wed 10/25/2017 3:15 PM
Inbox

to: Donna L. Gurley <dgurley@olemiss.edu>

Hello,

You are invited to participate in a survey regarding note-taking methods.

Everyone participating will be entered into a drawing for one of ONE HUNDRED $10 prizes – a total of $1000.00 will be awarded.

Within the survey, you will be given more information and be asked to consent to participate and to have some of your FERPA protected information matched to your responses. (The researcher will not be able to match your identity with your responses or with your FERPA protected information.) Furthermore, you can drop out of the survey at any time by simply closing the web page.

Please call me at 662-816-4722 or e-mail me at dgurley@olemiss.edu if you have any questions.

Follow this link to the Survey:
Take the survey

Or copy and paste the URL below into your internet browser:
http://uofmmississippi.qualtrics.com/jfe/preview/SV_tjmtHkXNuM2Rgj3Q_CHL=preview

Thank you for your time,
Donna Gurley

Follow the link to opt out of future emails:
Click here to unsubscribe
Default Question Block

The purpose of this study

There is disagreement among researchers as to the best way to take notes in the classroom. Many students believe that they take better notes on a keyboard (for example, typing on a laptop), while others believe that they take better notes when writing by hand (for example, on paper or on a tablet with a stylus). No study has determined whether there is a relationship between the way students take notes and their grade point averages.

Your participation in this study will help us determine whether there is a relationship or not. If there is a relationship, that information may prove useful to students as they select the best way to learn in the classroom. You will also be asked some questions about your study habits and how well you control your current behavior to achieve long-term goals.
Consent to Participate in Research

Please read the following. At the end of the page you will be asked to consent to participation in this study.

Study Title: The Relationship Between Grade Point Average and Note Taking Method

Investigator: Donna L. Gurley
Department of Leadership and Counselor Education
209 Lyceum
University of Mississippi
University, MS 38677
(662) 915-5020
dgurley@olemiss.edu

Faculty Sponsor: Kerry B. Melear
Department of Leadership and Counselor Education
107 Guyton Hall
University of Mississippi
University, MS 38677
(662) 915-5016
kbm@olemiss.edu

What you will do for this study

1. Participants will answer all questions online. The study will take approximately 10 minutes to complete.
2. To begin participation, you will have to consent twice. The first form (at the bottom of this page) is a consent to participate in the study. The second form is a consent to have certain FERPA protected information used in this study.
3. You may drop out of this study at any time by simply exiting the program.
4. Questions on the survey include the manner in which you have taken notes, particularly on paper or on an electronic device, and whether using a keyboard or by writing by hand.
5. You will also be asked to complete the Self-Regulation Survey ("SRS") consisting of ten questions designed to determine an individual's ability to plan and implement actions to reach long-term goals.
6. Participants who complete the survey will be given the opportunity to win one of one hundred $10 prizes. You will be notified if you win one of the prizes.

Possible risks from your participation

Participants may feel uncomfortable completing the Self-Regulation Survey as it requires them to evaluate their ability to exert self-control. Participants with poor self-regulation may find such a self-evaluation stressful.

Benefits from your participation
Authorization to Release FERPA-Protected Student Records to Researchers

You must also consent to have some of your personal information linked to your responses to this survey. Specifically, the following information will be used: your classification, gender, ethnicity, overall GPA, GPA for fall 2016, ACT score, Major and School.

The Office of Institutional Research will match this information to your responses. Both your responses and your personal information will remain anonymous. Not even the researcher will have access to this information.

The Researchers:
• May use the Information only for purposes of the approved research project. Any new use of the information requires new approval from the participant.

The Office of Institutional Research will:
• Provide adequate protection for the information to ensure that it is not compromised or subject to unauthorized access.
• Ensure that no one outside the research team has access to the information.

Please select one of the following:

- I consent to the use of my FERPA protected information by the researcher and the Office of institutional Research in connection with this study. I understand that no further use of my information can be made without my written permission.
- I do not consent to having my FERPA protected information used.

Thank you for reading more about this research project. Have a great day!

Please answer each question to the best of your ability. If you do not answer every question, your answers may not be usable.

In classes where you take notes, do you usually take notes on paper or on an electronic device of some kind?

- On paper
- On a laptop or portable computer
- On a tablet
- On a smartphone
- On another type of device (Please describe.)
Please consider the courses you took during the fall semester of 2016. In those courses, please estimate the percentage of those courses in which you took notes by entering the information using a keyboard.

- 0%
- 10%
- 20%
- 30%
- 40%
- 50%
- 60%
- 70%
- 80%
- 90%
- 100%

Please consider all the courses that you have taken while an undergraduate student. To the best of your ability, please estimate the percentage of those courses in which you took notes by entering the information using a keyboard.

- 0%
- 10%
- 20%
- 30%
- 40%
- 50%
- 60%
- 70%
- 80%
- 90%
- 100%
For each of the following questions, select the answer that best applies to you. Please answer each item before moving on to the next.

<table>
<thead>
<tr>
<th>Completely true</th>
<th>Somewhat true</th>
<th>Barely true</th>
<th>Not at all true</th>
</tr>
</thead>
<tbody>
<tr>
<td>I can concentrate on one activity for a long time, if necessary.</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>If I am distracted from an activity, I don’t have any problem coming back to the topic quickly.</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>If an activity arouses my feelings too much, I can calm myself down so that I can continue with the activity soon.</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>If an activity requires a problem-oriented attitude, I can control my feelings.</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>If is difficult for me to suppress thoughts that interfere with what I need to do.</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>I can control my thoughts from distracting me from the task at hand.</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>When I worry about something, I cannot concentrate on an activity.</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>After an interruption, I don’t have any problem resuming my concentrated style of working.</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>I usually have a whole bunch of thoughts and feelings that interfere with my ability to work in a focused way.</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>I stay focused on my goal and don’t allow anything to distract me from my plan of action.</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>

Thank you for your participation in this survey. If your name is drawn for a prize, you will be notified as to where you can pick it up.

Block 1
Your license will expire in 5 days.

GET
FILE="/Users/donnagurley/Downloads/Note Taking Survey_October 16, 2017_07.3.sav".

GET
FILE="/Users/donnagurley/Documents/Personal/Note Taking/Set.10.16.2017.sav"

DATASET NAME DataSet1 WINDOW=FRONT.

DATASET NAME DataSet2 WINDOW=FRONT.

REGRESSION
/DESCRIPTIONS MEAN STDDEV CORR SIG N
/MISSING LISTWISE
/STATISTICS COEFF OUTS R ANOVA CHANGE ZPP
/CRITERIA=PIN(.05) POUT(.10)
/NOORIGIN
/DEPENDENT SEMESTER_GPA_FALL_2016.
/METHOD=ENTER Q20 SRSTotal ACT_COMPOSITE.

Regression
[DataSet2] /Users/donnagurley/Documents/Personal/Note Taking/Set.10.16.2017.sav

Descriptive Statistics

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>SEMESTER_GPA</td>
<td>3.3069</td>
<td>.644185</td>
<td>130</td>
</tr>
<tr>
<td>FALL 2016</td>
<td>3.64</td>
<td>3.266</td>
<td>130</td>
</tr>
</tbody>
</table>

Please consider the courses you took during the fall semester of 2016. In those courses, please estimate the percentage of those courses in which you took notes by entering the information using a keyboard.

SRSTotal       | 21.4769| 3.42634        | 130 |
ACT COMPOSITE  | 26.6000| 4.61309        | 130 |
### Correlations

Please consider the courses you took during the fall semester of 2016. In those courses, please estimate the percentage of those courses in which you took notes by entering the information using a keyboard.

<table>
<thead>
<tr>
<th>Pearson Correlation</th>
<th>SEMESTER GPA (FALL 2016)</th>
<th>SRSTotal</th>
<th>ACT COMPOSITE</th>
</tr>
</thead>
<tbody>
<tr>
<td>SEMESTER GPA (FALL 2016)</td>
<td>1.000</td>
<td>-.016</td>
<td>.034</td>
</tr>
<tr>
<td>SRSTotal</td>
<td>.034</td>
<td>-.009</td>
<td>1.000</td>
</tr>
<tr>
<td>ACT COMPOSITE</td>
<td>.352</td>
<td>-.189</td>
<td>-.010</td>
</tr>
</tbody>
</table>

**Sig. (1-tailed)**

Please consider the courses you took during the fall semester of 2016. In those courses, please estimate the percentage of those courses in which you took notes by entering the information using a keyboard.

<table>
<thead>
<tr>
<th>Sig. (1-tailed)</th>
<th>SEMESTER GPA (FALL 2016)</th>
<th>SRSTotal</th>
<th>ACT COMPOSITE</th>
</tr>
</thead>
<tbody>
<tr>
<td>SEMESTER GPA (FALL 2016)</td>
<td>.429</td>
<td>.458</td>
<td></td>
</tr>
<tr>
<td>SRSTotal</td>
<td>.350</td>
<td>.458</td>
<td></td>
</tr>
<tr>
<td>ACT COMPOSITE</td>
<td>.000</td>
<td>.016</td>
<td>.453</td>
</tr>
</tbody>
</table>
## Correlations

<table>
<thead>
<tr>
<th></th>
<th>ACT COMPOSITE</th>
<th>SEMESTER GPA (FALL 2016)</th>
<th>Pearson Correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>.352</td>
</tr>
<tr>
<td>Please consider the</td>
<td></td>
<td></td>
<td>-.189</td>
</tr>
<tr>
<td>courses you took during</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>the fall semester of</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2016. In those courses,</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>please estimate the</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>percentage of those</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>courses in which you</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>took notes by entering</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>the information using a</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>keyboard.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SRSTotal</td>
<td></td>
<td></td>
<td>-.010</td>
</tr>
<tr>
<td>ACT COMPOSITE</td>
<td></td>
<td></td>
<td>1.000</td>
</tr>
<tr>
<td>Sig. (1-tailed)</td>
<td></td>
<td></td>
<td>.000</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>.016</td>
</tr>
<tr>
<td>Please consider the</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>courses you took during</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>the fall semester of</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2016. In those courses,</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>please estimate the</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>percentage of those</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>courses in which you</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>took notes by entering</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>the information using a</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>keyboard.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SRSTotal</td>
<td></td>
<td></td>
<td>.453</td>
</tr>
<tr>
<td>ACT COMPOSITE</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Correlations

<table>
<thead>
<tr>
<th>ACT COMPOSITE</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>SRSTotal</td>
</tr>
<tr>
<td>ACT COMPOSITE</td>
</tr>
</tbody>
</table>
### Variables Entered/Removed\(^a\)

<table>
<thead>
<tr>
<th>Model</th>
<th>Variables Entered</th>
<th>Variables Removed</th>
<th>Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ACT COMPOSITE, SRSTotal, Please consider the courses you took during the fall semester of 2016. In those courses, please estimate the percentage of those courses in which you took notes by entering the information using a keyboard.</td>
<td></td>
<td>Enter</td>
</tr>
</tbody>
</table>

\(^a\) Dependent Variable: SEMESTER GPA (FALL 2016)

\(^b\) All requested variables entered.

---

### Model Summary

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
<th>R Square Change</th>
<th>F Change</th>
<th>df1</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.357(^a)</td>
<td>.128</td>
<td>.107</td>
<td>.608743</td>
<td>.128</td>
<td>6.153</td>
<td>3</td>
</tr>
</tbody>
</table>

### Change Statistics

<table>
<thead>
<tr>
<th>Model</th>
<th>df1</th>
<th>Sig. F Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>126</td>
<td>.001</td>
</tr>
</tbody>
</table>

\(^a\) Predictors: (Constant), ACT COMPOSITE, SRSTotal, Please consider the courses you took during the fall semester of 2016. In those courses, please estimate the percentage of those courses in which you took notes by entering the information using a keyboard.
### ANOVA

<table>
<thead>
<tr>
<th>Model</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>6.840</td>
<td>3</td>
<td>2.280</td>
<td>6.153</td>
<td>.001&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Residual</td>
<td>46.692</td>
<td>126</td>
<td>.371</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>53.532</td>
<td>129</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a. Dependent Variable: SEMESTER GPA (FALL 2016)
b. Predictors: (Constant), ACT COMPOSITE, SRS Total, Please consider the courses you took during the fall semester of 2016. In those courses, please estimate the percentage of those courses in which you took notes by entering the information using a keyboard.

### Coefficients

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>t</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>Std. Error</td>
<td>Beta</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>(Constant)</td>
<td>1.793</td>
<td>.478</td>
<td>3.748</td>
</tr>
<tr>
<td></td>
<td>.010</td>
<td>.017</td>
<td>.053</td>
<td>.624</td>
</tr>
</tbody>
</table>

Please consider the courses you took during the fall semester of 2016. In those courses, please estimate the percentage of those courses in which you took notes by entering the information using a keyboard.

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>t</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>Std. Error</td>
<td>Beta</td>
<td></td>
</tr>
<tr>
<td>SRSTotal</td>
<td>.007</td>
<td>.016</td>
<td>.038</td>
<td>.463</td>
</tr>
<tr>
<td>ACT COMPOSITE</td>
<td>.051</td>
<td>.012</td>
<td>.362</td>
<td>4.273</td>
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</table>

### Coefficients

<table>
<thead>
<tr>
<th>Model</th>
<th>Correlations</th>
<th>Sig.</th>
<th>Zero-order</th>
<th>Partial</th>
<th>Part</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(Constant)</td>
<td>.000</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Please consider the courses you took during the fall semester of 2016. In those courses, please estimate the percentage of those courses in which you took notes by entering the information using a keyboard.

<table>
<thead>
<tr>
<th>Model</th>
<th>Correlations</th>
<th>Sig.</th>
<th>Zero-order</th>
<th>Partial</th>
<th>Part</th>
</tr>
</thead>
<tbody>
<tr>
<td>SRSTotal</td>
<td>.644</td>
<td>.034</td>
<td>.041</td>
<td>.038</td>
<td></td>
</tr>
<tr>
<td>ACT COMPOSITE</td>
<td>.000</td>
<td>.352</td>
<td>.356</td>
<td>.355</td>
<td></td>
</tr>
</tbody>
</table>
a. Dependent Variable: SEMESTER CPA (FALL 2016)

REGRESSION
/DESCRPTIVES MEAN STDDEV CORR SIG N
/MISSING LISTWISE
/STATISTICS COEFF OUTS R ANOVA CHANGE ZPP
/Criteria=PIN(.05) POUT(.10)
/NOORIGIN
/DEPENDENT OVERALL_GPA
/METHOD=ENTER SRSTotal ACT_COMPOSITE Q21.

Regression

Descriptive Statistics

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>OVERALL GPA</td>
<td>3.37562</td>
<td>.513073</td>
<td>130</td>
</tr>
<tr>
<td>SRSTotal</td>
<td>21.4769</td>
<td>3.42634</td>
<td>130</td>
</tr>
<tr>
<td>ACT COMPOSITE</td>
<td>26.6000</td>
<td>4.61309</td>
<td>130</td>
</tr>
<tr>
<td>Please consider all the courses that you have taken while an undergraduate student. To the best of your ability, please estimate the percentage of those courses in which you took notes by entering the information using a keyboard.</td>
<td>3.99</td>
<td>2.766</td>
<td>130</td>
</tr>
</tbody>
</table>
## Correlations

<table>
<thead>
<tr>
<th>Pearson Correlation</th>
<th>OVERALL GPA</th>
<th>SRSTotal</th>
<th>ACT COMPOSITE</th>
</tr>
</thead>
<tbody>
<tr>
<td>OVERALL GPA</td>
<td>1.000</td>
<td>.068</td>
<td>.428</td>
</tr>
<tr>
<td>SRSTotal</td>
<td>.068</td>
<td>1.000</td>
<td>-.010</td>
</tr>
<tr>
<td>ACT COMPOSITE</td>
<td>.428</td>
<td>-.010</td>
<td>1.000</td>
</tr>
<tr>
<td>Please consider all the courses that you have taken while an undergraduate student. To the best of your ability, please estimate the percentage of those courses in which you took notes by entering the information using a keyboard.</td>
<td>-.137</td>
<td>.002</td>
<td>-.257</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sig. (1-tailed)</th>
<th>OVERALL GPA</th>
<th>SRSTotal</th>
<th>ACT COMPOSITE</th>
</tr>
</thead>
<tbody>
<tr>
<td>OVERALL GPA</td>
<td></td>
<td>.221</td>
<td>.000</td>
</tr>
<tr>
<td>SRSTotal</td>
<td>.221</td>
<td></td>
<td>.453</td>
</tr>
<tr>
<td>ACT COMPOSITE</td>
<td>.000</td>
<td>.453</td>
<td></td>
</tr>
<tr>
<td>Please consider all the courses that you have taken while an undergraduate student. To the best of your ability, please estimate the percentage of those courses in which you took notes by entering the information using a keyboard.</td>
<td>.060</td>
<td>.491</td>
<td>.002</td>
</tr>
<tr>
<td>ACT COMPOSITE</td>
<td>SIE. (L-tailed)</td>
<td>SSTotal</td>
<td>OVERALL GPA</td>
</tr>
<tr>
<td>--------------</td>
<td>----------------</td>
<td>---------</td>
<td>-------------</td>
</tr>
<tr>
<td>491</td>
<td>0.002</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.000</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Correlations

<table>
<thead>
<tr>
<th>N</th>
<th>OVERALL GPA</th>
<th>SRSTotal</th>
<th>ACT COMPOSITE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>130</td>
<td>130</td>
<td>130</td>
</tr>
<tr>
<td></td>
<td>130</td>
<td>130</td>
<td>130</td>
</tr>
<tr>
<td></td>
<td>130</td>
<td>130</td>
<td>130</td>
</tr>
</tbody>
</table>

Please consider all the courses that you have taken while an undergraduate student. To the best of your ability, please estimate the percentage of those courses in which you took notes by entering the information using a keyboard.
Correlations

Please consider all the courses that you have taken while an undergraduate student. To the best of your ability, please estimate the percentage of those courses in which you took notes by entering the information using a keyboard.

<table>
<thead>
<tr>
<th>N</th>
<th>OVERALL GPA</th>
<th>130</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SRSTotal</td>
<td>130</td>
</tr>
<tr>
<td></td>
<td>ACT COMPOSITE</td>
<td>130</td>
</tr>
</tbody>
</table>

Please consider all the courses that you have taken while an undergraduate student. To the best of your ability, please estimate the percentage of those courses in which you took notes by entering the information using a keyboard.
### Variables Entered/Removed

<table>
<thead>
<tr>
<th>Model</th>
<th>Variables Entered</th>
<th>Variables Removed</th>
<th>Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Please consider all the courses that you have taken while an undergraduate student. To the best of your ability, please estimate the percentage of those courses in which you took notes by entering the information using a keyboard., SRSTotal, ACT COMPOSITE.</td>
<td></td>
<td>Enter</td>
</tr>
</tbody>
</table>

---

a. Dependent Variable: OVERALL CPA  
b. All requested variables entered.

### Model Summary

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
<th>R Square Change</th>
<th>F Change</th>
<th>df1</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.435</td>
<td>.189</td>
<td>.170</td>
<td>.467378</td>
<td>.189</td>
<td>9.819</td>
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### Change Statistics

<table>
<thead>
<tr>
<th>Model</th>
<th>df2</th>
<th>Sig. F Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>126</td>
<td>.000</td>
</tr>
</tbody>
</table>

---

a. Predictors: (Constant), Please consider all the courses that you have taken while an undergraduate student. To the best of your ability, please estimate the percentage of those courses in which you took notes by entering the information using a keyboard., SRSTotal, ACT COMPOSITE.
## ANOVA

<table>
<thead>
<tr>
<th>Model</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Regression</td>
<td>6.435</td>
<td>3</td>
<td>2.145</td>
<td>9.819</td>
</tr>
<tr>
<td></td>
<td>Residual</td>
<td>27.524</td>
<td>126</td>
<td>.218</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>33.958</td>
<td>129</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a. Dependent Variable: OVERALL GPA

b. Predictors: (Constant), Please consider all the courses that you have taken while an undergraduate student. To the best of your ability, please estimate the percentage of those courses in which you took notes by entering the information using a keyboard., SRSTotal, ACT COMPOSITE

## Coefficients

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>Std. Error</td>
</tr>
<tr>
<td>1</td>
<td>(Constant)</td>
<td>1.916</td>
</tr>
<tr>
<td></td>
<td>SRSTotal</td>
<td>.011</td>
</tr>
<tr>
<td></td>
<td>ACT COMPOSITE</td>
<td>.047</td>
</tr>
<tr>
<td></td>
<td>Please consider all the courses that you have taken while an undergraduate student. To the best of your ability, please estimate the percentage of those courses in which you took notes by entering the information using a keyboard.</td>
<td></td>
</tr>
</tbody>
</table>
Coefficients\textsuperscript{a}

<table>
<thead>
<tr>
<th>Model</th>
<th>Sig.</th>
<th>Zero-order</th>
<th>Partial</th>
<th>Part</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (Constant)</td>
<td>.000</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>SRSTotal</td>
<td>.367</td>
<td>.068</td>
<td>.080</td>
<td>.073</td>
</tr>
<tr>
<td>ACT COMPOSITE</td>
<td>.000</td>
<td>.428</td>
<td>.412</td>
<td>.408</td>
</tr>
</tbody>
</table>

Please consider all the courses that you have taken while an undergraduate student. To the best of your ability, please estimate the percentage of those courses in which you took notes by entering the information using a keyboard.

\textsuperscript{a} Dependent Variable: OVERALL GPA

REGRESSION
/DESCRIPTIVES MEAN STDDEV CORR SIG N
/MISSING LISTWISE
/STATISTICS COEFF OUTS R ANOVA CHANGE ZPP
/CRITERIA=PIN(.05) POUT(.10)
/NORIGIN
/DEPENDENT Q21
/METHOD=ENTER ACT_COMPOSITE.

Regression

Descriptive Statistics

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Please consider all the courses that you have taken while an undergraduate student. To the best of your ability, please estimate the percentage of those courses in which you took notes by entering the information using a keyboard.</td>
<td>3.99</td>
<td>2.766</td>
<td>130</td>
</tr>
<tr>
<td>ACT COMPOSITE</td>
<td>26.6000</td>
<td>4.61309</td>
<td>130</td>
</tr>
</tbody>
</table>
Correlations

Please consider all the courses that you have taken while an undergraduate student. To the best of your ability, please estimate the percentage of those courses in which you took notes by entering the information using a keyboard.

<table>
<thead>
<tr>
<th>Pearson Correlation</th>
<th>ACT COMPOSITE</th>
<th>Sig. (1-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Please consider all the courses that you have taken while an undergraduate student. To the best of your ability, please estimate the percentage of those courses in which you took notes by entering the information using a keyboard.</td>
<td>1.000</td>
<td>.002</td>
</tr>
<tr>
<td>ACT COMPOSITE</td>
<td>-.257</td>
<td>1.000</td>
</tr>
</tbody>
</table>

Page 16
Correlations

Please consider all the courses that you have taken while an undergraduate student. To the best of your ability, please estimate the percentage of those courses in which you took notes by entering the information using a keyboard.

<table>
<thead>
<tr>
<th>ACT COMPOSITE</th>
<th>130</th>
<th>130</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Variables Entered/Removed\(^a\)

<table>
<thead>
<tr>
<th>Model</th>
<th>Variables Entered</th>
<th>Variables Removed</th>
<th>Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ACT COMPOSITE(^b)</td>
<td>Enter</td>
<td></td>
</tr>
</tbody>
</table>

\(^a\) Dependent Variable: Please consider all the courses that you have taken while an undergraduate student. To the best of your ability, please estimate the percentage of those courses in which you took notes by entering the information using a keyboard.

\(^b\) All requested variables entered.
### Model Summary

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adj. R Square</th>
<th>Std. Error of Estimate</th>
<th>Rsq Change</th>
<th>F Change</th>
<th>df1</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.257^a</td>
<td>.066</td>
<td>.059</td>
<td>2.684</td>
<td>.066</td>
<td>9.023</td>
<td>1</td>
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</tbody>
</table>

#### Change Statistics

<table>
<thead>
<tr>
<th>Model</th>
<th>df2</th>
<th>Sig. F Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>128</td>
<td>.003</td>
</tr>
</tbody>
</table>

a. Predictors: (Constant), ACT COMPOSITE

### ANOVA

<table>
<thead>
<tr>
<th>Model</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>64.994</td>
<td>1</td>
<td>64.994</td>
<td>9.023</td>
<td>.003^b</td>
</tr>
<tr>
<td>Residual</td>
<td>921.998</td>
<td>128</td>
<td>7.203</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>986.992</td>
<td>129</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a. Dependent Variable: Please consider all the courses that you have taken while an undergraduate student. To the best of your ability, please estimate the percentage of those courses in which you took notes by entering the information using a keyboard.

b. Predictors: (Constant), ACT COMPOSITE

### Coefficients

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>Std. Error</td>
</tr>
<tr>
<td>1</td>
<td>(Constant)</td>
<td>8.085</td>
</tr>
<tr>
<td></td>
<td>ACT COMPOSITE</td>
<td>-.154</td>
</tr>
</tbody>
</table>

### Coefficients

<table>
<thead>
<tr>
<th>Correlations</th>
<th>Zero-order</th>
<th>Partial</th>
<th>Part</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (Constant)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ACT COMPOSITE</td>
<td>-.257</td>
<td>-.257</td>
<td>-.257</td>
</tr>
</tbody>
</table>
a. Dependent Variable: Please consider all the courses that you have taken while an undergraduate student. To the best of your ability, please estimate the percentage of those courses in which you took notes by entering the information using a keyboard.
VITA

DONNA L. GURLEY

571 County Road ∙ Paris, MS 38949 ∙ (662) 513-4389 ∙ dgurley@olemiss.edu

EDUCATION

Ph.D., Higher Education, University of Mississippi, May 2018
Dissertation: The Relationship Between Note-Taking Method and Grade Point Average
When Controlling for ACT Score and Self-Regulation Ability in Undergraduate Students

J.D., University of Mississippi School of Law, May 2000
GPA: 3.8/4.0; Rank 2/129; Summa Cum Laude

M.A., Education, University of Mississippi, August 1993
GPA (4.0/4.0)

M.L.S, Library Science, University of Mississippi, May 1984
GPA (4.0/4.0)

B.A., Education, University of Mississippi, May 1984
Concentration: Secondary Education/English (3.95/4.0), Summa Cum Laude

TEACHING EXPERIENCE

Adjunct Professor, 2002-03
University of Mississippi School of Law

Instructor, 2018
University of Mississippi

HONORS and FELLOWSHIPS

Mississippi Law Journal, Staff (1989); Associate Articles Editor (1999-00)
Robert C. Khayat Mississippi Law Journal Award
James Oliver Eastland Scholarship Recipient
Pat D. Holcomb Memorial Award for Excellence
Frederick P. Hamel Memorial Award
West Group Outstanding Scholastic Achievement Award (1998)
Travis Memorial Scholarship
Young Lawyers of the Mississippi Bar Scholarship
Albert N. Hopkins Scholarship (2000)
Steen Reynolds Dalehite Trial Competition Semi-Finalist
Barnes and Noble Textbook Scholarship
Governor William Waller Criminal Law Award
Martha Wilson Gerald MWLA Scholarship
Mississippi Bar Foundation Scholarship
Who’s Who American Law Students-18th and 19th eds.
Bar Admissions:
  Mississippi, September 2000
  District Court for the Northern District of Mississippi
  District Court for the Southern District of Mississippi
  Arkansas, May 2002 (inactive)
U.S. Court of Appeals for the Fifth Circuit
Leadership Mississippi Graduate, 2002
Lamar Order, University of Mississippi
University Fellow, 1982-83
Taylor Medalist, 1982
Phi Kappa Phi Honor Society
Class Marshall, University of Mississippi School of Education
M.L.S. Accredited by the American Library Association

PUBLICATIONS and PRESENTATIONS