

THE INFLUENCE OF TEXT MESSAGING
ON MEASURES OF STUDENT WRITING:
A META-ANALYTIC REVIEW

by

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ABSTRACT

The popularity of the cellular telephone among students from elementary school to college has become increasingly evident; students use text messaging so frequently that many people both inside and outside of academia question whether text messaging language shortcuts (textisms or textese) influence students' academic writing competencies. Performance results from the most recent *Nation's Report Card: Writing 2011* showed that two-thirds of the nation's 8th and 12th graders, approximately 5 million students, had only partial mastery of the knowledge and skills that are fundamental for proficient writing at these grade levels. These assessment outcomes on standardized tests are especially perplexing because research has shown that students today spend more time writing than any previous generation, yet determining whether text-message communication interferes with students' formal writing abilities is a complex question because writing is a complex process. Previous research showed that indeed, text messaging did have a positive correlation with writing-related assessment outcomes, though other research showed no correlations or negative correlations. The purpose of this study was to collect and meta-analyze findings of previous research that correlated text messaging and student writing proficiencies.

This research used 17 sets of data from 14 studies, representing assessment measures from 1,652 students. The average effect size between text messaging and writing-related assessment outcomes was .28, and the overall mean r value was .24, indicating that text messaging has a significant positive impact on writing-related assessment outcomes. Other results showed the mean effect of text messaging on writing-related assessment outcomes did not

differ significantly between K-12 and undergraduate students ($Q_B = 1.26; p = .26$). This indicates school level was not shown to be an effective moderating factor. Overall, writing assessment outcomes did not vary based on school level. Lastly, the mean effect of text messaging on writing-related assessment outcomes did not differ significantly between writing standards ($Q_B = 1.33; p = .25$). This indicates that the standard of writing evaluation, grammar or spelling, was not shown to be an effective moderating factor when analyzing text messaging's influence on overall writing-related assessment outcomes. Overall, writing assessment outcomes did not vary based specific writing measure.

DEDICATION

Thank you to my mom for always being there, no matter what. I love you, Mom.

This dissertation is dedicated to the two most incredibly beautiful, willful, smart, sensitive, and loving people I know, Gunnar and Hayden. You have given me the greatest gift I have ever received – perspective and purpose, and I love you both without measure.

And last, but never, ever least, thank you to my husband and partner, TJ, for his endless reassurances that I could finish this project. TJ, thank you for always being my biggest fan, my loudest cheerleader, and my best friend. I hope you are as proud of me as I am of you.

LIST OF ABBREVIATIONS AND SYMBOLS

α	Cronbach's index of internal consistency
<i>BAS II</i>	British Ability Scales II (Elliott, Murray, & Pearson, 1997)
<i>CogAT</i>	Cognitive Abilities Test (Lohman & Hagen, 2002)
<i>df</i>	Degrees of freedom: number of values free to vary after certain restrictions have been placed on the data
ES	Effect size: the magnitude of an effect or the strength of a relationship between variables
<i>M</i>	Mean: the sum of a set of measurements divided by the number of measurements in the set
<i>n</i>	Number of cases in a subsample
<i>N</i>	Total number of cases in study
<i>p</i>	Probability associated with the occurrence under the null hypothesis of a value as extreme as or more extreme than the observed value
<i>r</i>	Pearson product-moment correlation
r^2	Multiple correlation squared; measure of strength of association
<i>T</i>	The sample value of the <i>t</i> -test statistic
<i>TROG</i>	Test for Reception of Grammar (Bishop, 1989)
<i>WJ</i>	Woodcock Johnson Tests of Achievement (Woodcock, McGrew, & Mather, 2001)
<i>WRAT</i>	Wide Range Achievement Test (Wilkinson, 1993)
χ^2	Pearson's chi-squared test

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CHAPTER I

INTRODUCTION

Background

The popularity of the cellular telephone among students from elementary school to college has become increasingly evident. For many students, the cell phone is just as important as pencils, notebooks, and textbooks because one of the most widely used features of cell phones is the text messaging service. Text messaging has become a vital part of students' social lives (Harley, Winn, Pemberton, & Wilcox, 2007) because today's youth have grown up using computers and the internet. This generation of learners is technologically literate and as a result avid users and consumers of wireless technology (Oksman & Turtiainen, 2004). Students use text messaging so frequently that many people both inside and outside of academia question whether text messaging language shortcuts, referred to as textisms or textese, influence students' academic writing competencies (Bauerlein, 2011; Crystal, 2008; Wood, Kemp, & Plester, 2016). Carrington (2005) asserted

Polemic, or oppositional positions, between Standard English and txtng [*sic*] are discursively constructed, with txtng [*sic*] represented as the abnormal intruder... There is almost the unspoken comment here that recreational use of txtng [*sic*] may ultimately lead to addiction and a lowering of an individual's ability to shift between text types according to social context—that increasing mastery and use of txt [*sic*] must ipso facto lead to withering skills around other text forms embraced within the parameters of Standard English. (p. 167)

Whether text-message communication interferes with students' formal writing abilities is a complex question because writing is a complex process. Writing involves perhaps more subskills than any other academic task, and writing well requires students to employ multiple

physical and mental processes in one concentrated effort not only to convey information and ideas, but also to do so in an academically appropriate style and format (Levine, 2002). Of course, it is logical to wonder whether text messaging use can diminish student writing ability, enhance student writing ability, perhaps do neither, or perhaps do both; however, before these relationships can be studied, a paradigm for writing evaluation must be established. Finding a general consensus of what constitutes proficient writing versus incompetent writing presents problems because “. . . professionals have not reached definitive conclusions about the problem of how to assess writing . . .” (Elbow, 1993, p. 187). Not until the standards of writing proficiency are established can the relationship between text messaging and student writing proficiency begin.

Standardized Writing Assessments

The state of public education is a highly debated issue in US domestic policy today. People alternate between praising teachers, students, parents, and administrators for the reported successes of the system, to blaming teachers, students, parents, and administrators for the failures, while often neglecting to address the complex manner in which teachers teach and students learn. Over the last decade, various federal policies have made school administrators and teachers directly accountable for student performance on high-stakes assessments, including those that focus on academic writing proficiency.

The National Assessment Governing Board (2010) defined the three levels of writing achievement as the following.

- **Advanced:** This level signifies superior performance.
- **Proficient:** This level represents solid academic performance for each grade assessed. Students reaching this level have demonstrated competency over challenging subject matter, including subject-matter knowledge, application of such knowledge to real-world situations, and analytical skills appropriate to the subject matter.

- Basic: This level denotes partial mastery of prerequisite knowledge and skills that are fundamental for proficient work at each grade. (p. 13)

Performance results from the most recent *Nation's Report Card: Writing 2011* showed that 24% of eighth-grade students performed with proficient writing abilities, and 3% performed with advanced-level writing abilities. Similarly, 24% of 12th-grade students were reported as proficient writers, while less than 3% showed advanced proficiency with writing abilities (National Center for Education Statistics, 2012). These results indicated that two-thirds of 8th and 12th graders, approximately 5 million students, had only partial mastery of the prerequisite knowledge and skills that are fundamental for proficient writing at these grade levels (Bauman & Davis, 2013).

Whether an advocate or an opponent, the Elementary and Secondary Education Act of 1965 (1965) [ESEA] has compelled parents, students, teachers, and school leaders to reassess the meaning of success and failure within public schools. For the past decade, ESEA was more commonly known as the No Child Left Behind Act of 2001 (2002) [NCLB] and during this time, the terms *standards*, *assessments*, and *accountability* became nomenclature in our schools. Although the negative effects of NCLB's mandates have been widely noted, positive results have been agreed upon, as well. In addition to highlighting student achievement gaps based on demographics (Martin, Martin, Gibson, & Wilkins, 2007), NCLB also underscored existing discrepancies between state and national assessment results ("A Bad Report Card," 2007; Cronin, Dahlin, Adkins, & Kingsbury, 2007; "Test and Switch," 2007). Specifically, state mandated writing assessments reported generally high proficiency levels, but the federally mandated National Assessment of Educational Progress [NAEP] assessments reported generally low levels of proficiency for the same students (Lee, Grigg, & Donahue, 2007; Salah-Din, Persky, & Miller, 2008). This discrepancy is especially relevant to writing assessments, as

conceptualizations of proficiency are highly variable due to the overall subjectivity of the importance and weight of composition constructs (Weigle, 2002).

On December 10, 2015, President Barack Obama reauthorized ESEA by signing into law the Every Student Succeeds Act of 2015 (2016) [ESSA]. Although much of NCLB's requirements remain intact, ESSA does make an important change in regard to high-stakes writing assessment. According to the new guidelines, school districts may choose to use a nationally recognized high school test instead of the state exam. For high school students, these include any test that is administered in multiple states and is accepted by institutions of higher education in those or other states for college entrance or placement. That means SAT, ACT, Partnership for Assessment of Readiness for College and Careers (PARCC), and Smarter Balanced assessment scores, as well as Advanced Placement and International Baccalaureate test scores, will be valid; however, the currently used NAEP test will not be administered to high school students because it is neither a college entrance test nor a college placement test. Though the means of evaluating student writing proficiency is changing, student writing assessments are not going away. Unless educators determine the cause of poor student writing proficiency, the possibility that the next decade of assessments and evaluations will show similar results as the NAEP is quite real.

When test results indicate that students within the same classroom, school, or state, lag behind their counterparts, or that students lack the basic writing skills needed to be proficient, parents, educators, and the general public demand an explanation for the failure. This dissertation seeks to provide an explanation as to whether text messaging use has contributed to the dismal results of student writing outcomes. This dissertation does not focus on the validity and reliability of mandated assessments, though that is a topic worthy of exploration; however, the

implementation of Common Core Standards, in addition to the already present standardized writing assessments, has provided the public with data that reflect the condition of student writing abilities in the United States. Included in these assessments and standards is a focus on academic writing proficiency, and educators and other stakeholders fear that students will substitute their most frequently utilized form of communication, texting, in place of appropriate sentence patterns, grammar use, punctuation placement, and word choice (Bauerlein, 2010).

The Influence of Text Messaging

These dismal assessment outcomes on standardized tests are especially perplexing because research has shown that students today spend more time writing than students of any previous generation (Baron, 2011; Bauerlein, 2008, 2010). Not since the invention and widespread use of the telephone has society favored the written word over voice communication (Roschke, 2008), and students today are writing at approximately three times the rate of students 25 years ago (Lunsford, 2013); however, 25 years ago, students were not sending and receiving text messages.

According to Lenhart, Smith, Anderson, Duggan, and Perrin (2015) at the Pew Institute, for many teens, texting is the primary way that they communicate with their friends on a day-to-day basis. According to Lenhart et al., 88% of adolescents and teenagers text messaged with their friends at least occasionally, and 55% text messaged their friends daily. Another study performed by Lenhart (2012) found that one-third of teenagers sent over 100 texts each day, which equates to more than 3,000 texts per month. Nielsen Wire (2010) reported that no group communicated by text messaging more than adolescent females 12-17 years old, who averaged 4,050 texts per month. Boys of the same age averaged 2,539 texts per month. To provide context to these statistics, the next highest texting average was 1,630 texts per month among 18-24 year-olds.

Once referred to as SMS (short message service) messaging, a text, or text message, is an electronic communication sent or received by mobile phone.

The first text message communication was sent on December 3, 1992, when Neil Papworth, a 22-year-old test engineer in the United Kingdom used a personal computer to send the text message "Merry Christmas" via the Vodafone network to the phone of Richard Jarvis who was at a party in Newbury, Berkshire. The party had been organized to celebrate the world's first text message transmission. Today, text messaging suggests a phone-to-phone communication. The introduction of mobile phones and texting has greatly impacted the way in which people communicate (Kemp & Bushnell, 2011), and texting is reported as the most preferred type of communication (Cingel & Sundar, 2012). No longer do people have to make phone calls to keep in touch with friends and family; now, they can simply type a short message stating whatever they need to say. Whether called SMSing, text messaging, or texting, educators can be fairly assured that this means of communication is here to stay (Crystal, 2008), at least until replaced by a simpler, faster, and perhaps even more character-efficient means of communication.

Text messaging communication has increased exponentially since its development for commercial use in 1992 (Hadfield & Hadfield, 2008), and the use of text messaging to communicate has been widely adopted by adults, teenagers, and children across the world (Dawson, 2010). Texting became phonetic-based for many users, variations on orthographic conventions, such as spelling, hyphenation, capitalization, word breaks, emphasis, and punctuation, soon developed. Textese is often written as one speaks (Thurlow, 2003), and students monitor themselves and others, which helps create the rules (Plester, Lerkkanen, Linjama, Rasku Puttonen, & Littleton, 2011).

Research on Texting and Writing

The increasing popularity of texting at progressively younger ages has prompted parents and teachers to worry about the influence of text messaging on children's literacy skills.

Although text messaging may not be new technology any longer, texting's effects on students' proficiency with formal, written English has yet to be decided. Research on the effects of text messaging on students' writing abilities continues to grow, and as the research continues to accumulate, many people both inside and outside of academia have begun to debate whether the abbreviated language used in texting is responsible for the low numbers of students identified as proficient writers. Kate Ross of the American Federation of Teachers stated,

Text and instant messaging are negatively affecting students' writing quality on a daily basis, as they bring their abbreviated language into the classroom. As a result of their electronic chatting, kids are making countless syntax, subject-verb agreement and spelling mistakes in writing assignments....[M]any teachers believed that students' wide use of "text speak" was a key factor in their students' negative performance....[T]ext speak is a problem. (2007, p. 4)

This statement characterizes concerns that exposure to and use of unconventional spelling in text messaging may cause literacy problems, compromising reading, writing, and spelling abilities.

Sutherland (2002) also reflected this concern when he ridiculed textese by presenting Hamlet's existential question in textese: "2B or 2b (not) =?" He then summarized textese as "snot-talk," "unimaginative," "bleak, bald, sad shorthand," and "drab shrinktalk" (p. 11). Sutherland concluded with his claim that textese, "masks dyslexia, poor spelling and mental laziness" (p. 12).

Ross and Sutherland provide clear examples of what Crystal (2008) referred to as a "huge mythology," in which exaggerated and inaccurate accounts of the connection between waning literacy skills and the language of text messaging are viewed as an "impending linguistic disaster," causing widespread "moral panic" throughout society (p. 7). Coe and Oakhill (2011)

asserted that the media has purported, “substantial speculation and concern about the possible harmful effects of frequent text messaging on literacy skills” (p. 5). Thurlow’s (2006) critical review of 101 articles, published between 2000 and 2005 from various English-speaking countries, confirmed that media views on young people’s language use in texting is “overwhelmingly pessimistic” (p. 677). Thurlow summarized that text messaging was regarded as *reprehensible, frightening, depraved, criminal, apocalyptic, and aberrant* and was constantly put in negative opposition to proper language.

Despite the negative assertions related to the influence of textese on Standard English structures, others claim that rather than causing havoc on language and literacy practices, texting may provide children and adolescents with “increased exposure to text” and extra opportunities to engage with language (Plester & Wood, 2009, p. 1100). As such, the very act of texting may motivate young people to read and write. Another possible result of texting is that textisms may increase learner phonological or metalinguistic awareness; that is, a student’s exposure to the underlying sound structure of language may occur sooner and more frequently than without text messaging. For example, phonological abbreviations (*fone* for *phone*) and letter/number homophones (*gr8* for *great*) reflect an understanding of the grapheme phoneme patterns (letter-sound correspondences) of a language (Crystal, 2008).

As opposed to Sutherland’s argument that used Shakespeare in his example of the damage text messaging can create for language, Baron (2005) used Shakespeare to argue the opposite. She stated that strict spelling norms should not be seen as model for showcasing literacy skills, as, “even Shakespeare spelled his own name at least six different ways” (p. 29). Baron went on to state that textese is actually an empowering phenomenon. She stated that the “writing style commonly used in texting need not spell the end of normative language,” provided

that young people are instructed on when they can be creative in their language use and when they should adhere to conventional spelling standards (p. 31).

These are the two contrasting views held by many in regard to the effect that text messaging is having on literacy skills (Crystal, 2008). Some believe that texting has a negative impact on youth literacy and some believe that texting has a positive impact. By presenting an overview of the empirical research pertaining to this issue published between 2008 and 2014, this review of the literature explored the effects of texting on writing proficiency among students.

Statement of the Problem

The problem that this study addressed is the perception that students' academic writing skills are declining as a result of the utilization of texting. If texting language is being incorporated into the work that students are submitting to their instructors, texting has the potential to affect students' ability to write formally and possibly the ability to read and comprehend formal writing (Moore, Boyd, & Dooley, 2010). Noting that some studies offered more than one data set using separate populations of students, some research showed positive relationships between text messaging and writing-related assessment outcomes in English-speaking students (Bushnell, Kemp, & Martin, 2011; Cingel & Sundar, 2012; Drouin, 2011; Durkin, Conti-Ramsden, & Walker, 2011; Kemp, 2010, Kemp & Bushnell, 2011; Kemp, Wood, & Waldron, 2014; Plester, Wood, & Bell, 2008; Plester, Wood, & Joshi, 2009). Other studies showed negative relationships between text messaging and writing-related assessment outcomes in English-speaking students (De Jonge & Kemp, 2012; Drouin & Davis, 2009; Grace, Kemp, Martin, & Parrila, 2014, Varnhagen et al., 2010), and one study showed no relationship at all between text messaging and writing-related assessment outcomes (Wood, Jackson, Hart, Plester,

& Wilde, 2011). This necessitates the need for research and analysis that can more clearly determine whether text messaging impacts students' academic writing.

Purpose of the Study

When establishing the relationship between behaviors and outcomes, association studies are required (Moola et al., 2015). These studies, also referred to as correlational studies, aim to summarize associations between variables. The overarching purpose of this study was to identify and synthesize the best available evidence on the association between text messaging and student writing proficiency. Because studies examining the direct correlation between the independent variable (text messaging) and the dependent variable (student writing outcomes) did not exist, this study focused on research examining the association between the independent variable (text messaging) and the dependent variable (the assessment domains specific to the NAEP 2011 Writing Assessment).

The 2011 NAEP Writing Assessment evaluated 4th, 8th, and 12th grade student writing across three broad domains. The domains of assessment included (a) Development of ideas, (b) Organization of ideas, and (c) Language facility and conventions. Though broad, these domains are consistent with learning standards and benchmarks in most states. In 2006, over 90% of states' standards, benchmarks, and assessments at grades 4, 8, and 12 included development and organization of ideas, style and varied sentence structure, vocabulary and precise diction, and conventions of standard written English, which include grammar, usage, punctuation, capitalization, and spelling (National Assessment Governing Board, 2010).

Research Questions

The National Assessment Governing Board (2010) acknowledged that “[w]riting is a complex, multifaceted and purposeful act of communication that is accomplished in a variety of

environments, under various constraints of time, and with a variety of language resources and technological tools” (p. 3). Not only is writing a complex task, but writing is perhaps the one area of a standardized assessment remaining that is scored by people. The 2011 NAEP Writing Assessment was scored by “trained readers . . . who decided on a single score (one number on the scale of 1 to 6) based on a judgment about the relative strengths and weaknesses of the [student’s] response in relation to specified criteria” (National Assessment Governing Board, 2010, p. 11). There are many variables that have an impact on student writing assessment outcomes; however, this study focused on determining the impact that text messaging had upon student writing skills as reflected in the criteria used to score the 2011 NAEP.

The research questions in this study were as follows:

1. What is the impact¹ of students’ use of text messaging on their academic writing, as shown on performance assessment outcomes?
2. Does the impact of students’ use of text messaging on their academic writing as shown on performance assessment outcomes differ across educational levels (i.e., K-12 vs. undergraduate college)?
3. Does the impact of students’ use of text messaging on their academic writing as shown on performance assessment outcomes differ across domains of writing (i.e., grammar vs. spelling)?

Overview of Methodology

Almost 40 years ago, Smith and Glass (1977) published “Meta-Analysis of Psychotherapy Outcome Studies,” establishing a new method of summative quantitative research, meta-analysis. Researchers Schmidt and Hunter (1977) and Rosenthal and Rubin

¹ In this study “impact” does not encompass causal relationships; rather, it indicates a correlational relationship between text messaging and writing-related assessment outcomes.

(1978) soon followed, publishing other meta-analytic reviews. Together these researchers established meta-analysis as a valid research methodology in the social sciences (Lipsey & Wilson, 2001). Although meta-analyses were typically used to determine the effectiveness of a particular intervention, they are also widely used to answer questions about etiology, or causes of problems (Petticrew & Roberts, 2008). This was the case in the present study, as we wanted to know if text messaging causes the problems with students' academic writing proficiency.

Meta-analysis allows the researcher to combine the quantitative results of a number of empirical studies to arrive at a single calculated common measure, called an effect size. These effects can then be quantified, interpreted, and compared, and the findings of a meta-analysis can be useful for those who seek a fuller, more comprehensive answer regarding a particular research question. This can be of value when the current review of literature shows conflicting research results or when the available studies are far too localized in population or limited in sample size (Arthur, Bennett, & Huffcutt, 2001).

Benefits of Meta-analysis

Research literature is growing at an exponential rate, and as the results accumulate, it becomes increasingly difficult to understand what all of the findings suggest (Rudner, Glass, Evartt, & Emery, 2002). Original research and narrative reviews often provide imprecise answers to the most clearly-defined and well-planned questions, and these ambiguous and conflicting quantitative findings can cause frustration for those who depend on concrete conclusions in order to make evidence-based decisions (Rudner et al., 2002). This is not a new problem. In 1970, Senator Walter Mondale expressed his frustration to the American Psychological Association when he stated,

What I have not learned is what we should do about these [educational] problems. For every study, statistical or theoretical, that contains a proposed solution or

recommendation, there is always another equally well-documented study, challenging the assumptions or conclusions of the first. No one seems to agree with anyone else's approach. But more distressing: no one seems to know what works. (Rudner et al., 2002, p. 3)

A scientific study should be designed and reported in such a way that it can be replicated by other researchers; however, researchers seldom attempt to replicate previous findings (Rudner et al., 2002). Often, researchers pursue new research, and the result can be an overwhelming number of studies on a given topic, with no two studies being exactly alike. Meta-analyses provide a possible solution to this problem. Figure 1 shows the relationship between meta-analytic reviews and other types of literature reviews.

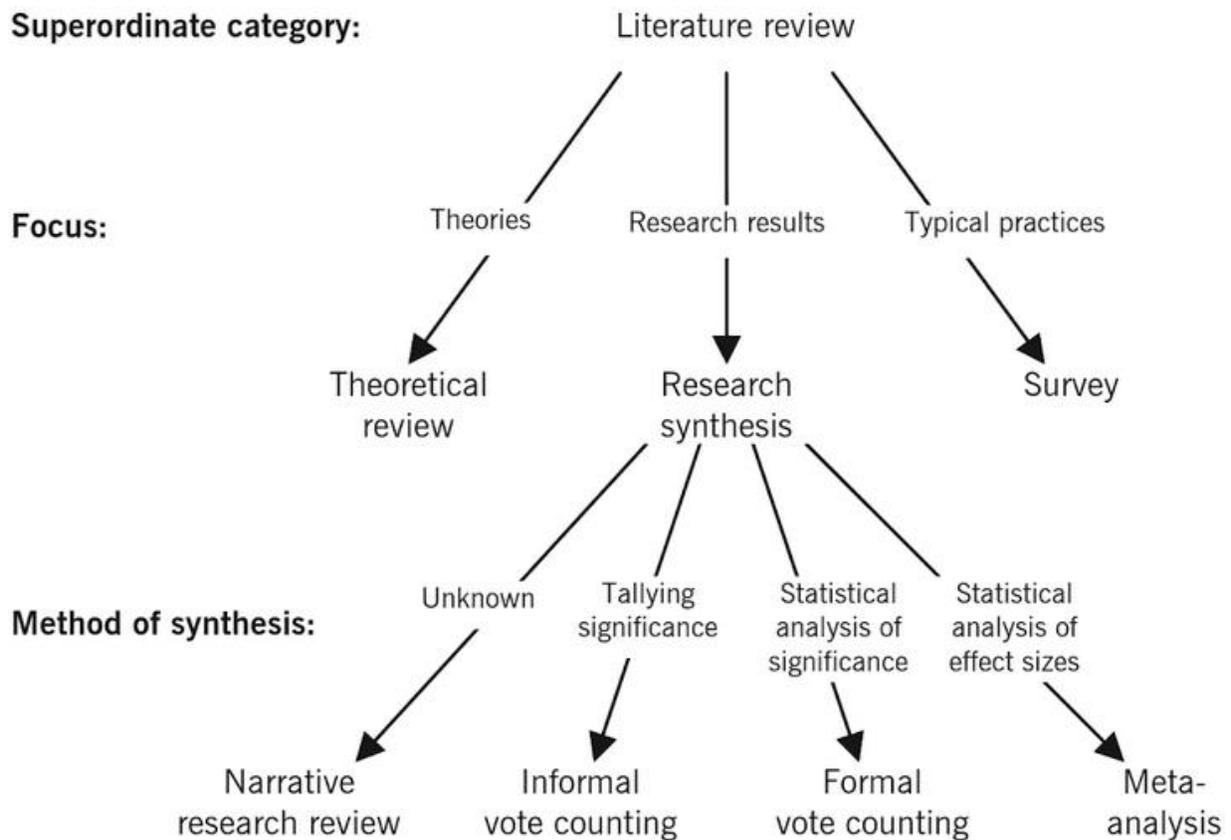


Figure 1. Relationship between meta-analytic reviews and other literature reviews. Reprinted from Card, N.A. (2015). *Applied meta-analysis for social science research* (p. 6). New York: Guilford Publications.

A meta-analysis is a research synthesis tool used to summarize the relationship between two variables across a body of primary studies and to answer questions not addressed in the individual studies (Borenstein, Hedges, Higgins, & Rothstein, 2009; Glass, 1976). The assembled data are used to calculate the average magnitude of the relationship between the two variables in question and to examine the extent to which conceptually relevant moderator variables strengthen or weaken this relationship (Lipsey & Wilson, 2001). A standard effect size is first calculated for each of the included studies followed by a calculation of a summary effect size generated by pooling effect sizes from each of the individual studies (Petticrew & Roberts, 2008) (see Chapter III for detailed information on conducting a meta-analysis). Meta-analysis is now a widely accepted method of summarizing multiple empirical studies within the field of education (Lipsey & Wilson, 2001).

Perhaps the most important benefit of meta-analysis is its potential for generating explanatory knowledge of the “intervening mechanisms through which a treatment causes its effects” (Cook et al., 1992, p. 14). This benefit is particularly useful when synthesizing literature that is comprised of studies that test different content and pedagogical arrangements. While an individual study can be set up to test a specific question or relationship, a meta-analysis can explore a wider range of theoretical variations and identify specific conditions that facilitate an effect. The explanatory knowledge gained from meta-analyses can produce immediate recommendations for instructional practice, and knowledge of these conditions can guide immediate changes to instructional practice (Cook et al., 1992). Because the findings in the existing research studies on text messaging and academic writing proficiencies are limited in scope and localized in population, this study will use meta-analysis to collect and synthesize the various studies, producing a big picture of the relationship.

Limitations of Meta-analysis

Meta-analysis is not without its limitations. The limitations associated with meta-analysis are described as (a) comparing apples to oranges, (b) garbage in garbage out, (c) the file drawer problem, and (d) publication bias

These limitations are applicable to most methodologies but they are most commonly attributed to meta-analysis (Cooper, 2010). These limitations are detailed below.

Comparing apples to oranges. According to Glass, Smith, and McGaw (1981), from the 1970s to the present critics have regarded meta-analysis as an invalid methodology because it compares “apples to oranges.” Glass has steadfastly defended meta-analysis by stating, “Of course it mixes apples and oranges; in the study of fruit nothing else is sensible; comparing apples and oranges is the only endeavor worthy of true scientists; comparing apples to apples is trivial” (2000, para. 23). In meta-analysis, data sets from multiple studies are combined and assessed for effect size. Critics argue that often data sets are too dissimilar to be included in a meta-analysis, resulting in skewed results and furthering the notion of *garbage in garbage out* (see below); however, the aim of meta-analysis is to be able to examine all the research and hence contribute to the rigor of the meta-analysis. Inclusionary and exclusionary criteria also help to control for mixing data that are too divergent (Littell, Corcoran, & Pillai, 2008).

Garbage in, garbage out. Another criticism of meta-analysis is the notion of “garbage in garbage out.” This refers to the quality of the studies used in meta-analysis research. Because the aim of meta-analysis is to include all research, the quality of particular research included may lack eminence. In this case, the integrity of the meta-analysis comes into question. Lipsey and Wilson (2001) suggested only including research that is well-designed; however, there is no

consensus as to what constitutes quality research. Rigorous coding procedures can help determine which studies are to be included or excluded.

File drawer problem. The file drawer problem refers to fugitive or gray literature that is difficult to find as it is unpublished and may be sitting in the ‘file drawer’ of a researcher due to non-significant findings (Rosenthal & DiMatteo, 2001). According to Cooper (2010), unpublished research is often as superior as published research but may not be published due to the results being non-significant. In meta-analysis, it is important to include fugitive data to determine effect sizes for research but to also account and control for publication bias.

Publication bias. When combining p -values obtained through published studies, an upwards bias into the effect sizes can be the result (Lipsey & Wilson, 2001) When conducting any studies, particularly meta-analyses, it is important that this effect be reduced as much as possible. Including gray or fugitive literature is one way in which publication bias can be minimized (Lipsey & Wilson, 2001). As most published studies contradict a null hypothesis of no effect at 0.05, unpublished research and presentations, if available, will be included in this study to help minimize the selection bias (Borenstein et al., 2009).

Significance of the Study

Deconstructing federal, state, and school policies, accounting for varying teaching methods and unique classroom climates, while also considering each person’s individual cognitive processing abilities and social learning dynamics is an enormous, if not impossible, undertaking; however, this does not erase the fact that educators need to know the cause of students’ poor writing proficiency. This current research adds to the existing literature, and also provides a practical resource from which parents and educators can draw their own conclusions about the role text messaging has on their students’ writing proficiency.

Though text messaging is a fairly new means of communication, many studies have been conducted that attempt to show a relationship between text messaging and student literacy; however, a gap exists in the literature when considering text messaging's impact on students' writing proficiency. As of this writing, no meta-analyses were located that comprehensively examined the research involving text messaging and overall writing proficiency outcomes. This study begins to bridge the gap in the literature by reviewing and conducting a meta-analysis on all available studies on text messaging and writing proficiency.

Today's students are a generation of learners who not only want everything quickly, they receive everything quickly. This is evidenced by the popularity of text messaging and the use of language shortcuts, or textisms, that make the process of speedy communication even speedier. In addition to maintaining students' focus long enough to teach lessons, English teachers are also tasked with making sure students know the difference between informal text message writing and formal academic composition. After teachers know to what degree text messaging influences students' writing skills, adjustments can be made to the instruction. Whether text messaging negatively or positively affects academic writing proficiency, the fact remains that educators can use this knowledge to encourage greater writing proficiency among their students. Educators have a vested interest in improving students' academic writing proficiency, and this study used available research to provide the answers needed to make knowledgeable decisions.

Definitions

The language surrounding a meta-analysis on text messaging and academic writing is specific and requires further definition.

Achievement level descriptions. Statements established by the National Assessment Governing Board that define what students know and can do at each achievement level of writing (Basic, Proficient, and Advanced) (National Assessment Governing Board, 2010).

Advanced-level writing. Advanced-level writing represents superior academic writing proficiency for each grade assessed (National Center for Education Statistics, 2012).

Basic-level writing. Basic-level writing denotes partial mastery of the prerequisite knowledge and skills that are fundamental for proficient work at each grade (National Center for Education Statistics, 2012).

Conventions. Commonly accepted rules and guidelines for formal written language concerning grammar and usage, as well as mechanics (e.g., punctuation, capitalization, and spelling) (National Assessment Governing Board, 2010).

Domain. A broad feature of all writing (e.g., language facility), comprised of specific and important components that can be used to assess student performance within this feature (National Assessment Governing Board, 2010).

Effect Size. The effect size is the value which reflects the strength of a relationship between two variables (Borenstein et al., 2009).

Elementary school age students. Students between the ages of 5-10 years old.

High school age students. Students between the ages of 15-18 years old.

Homogeneity: Homogeneity answers the question whether the effect sizes that are averaged in the mean are all from the same population (Lipsey & Wilson, 2001).

Meta-analysis. A meta-analysis refers to the analysis of analyses (Glass, 1976).

Middle school age students. Students between the ages of 11-14 years old.

Moderator. Any variable used to explain the variance between at least two different variables (Arthur et al., 2001).

University undergraduate students. Students of any age identified as a college undergraduate.

Proficient-level writing. Proficient-level writing represents solid academic performance for each grade assessed. Students performing at this level have clearly demonstrated the ability to accomplish the communicative purpose of their writing (National Center for Education Statistics, 2012).

SMS language. Short message service language is another way to describe the abbreviated language utilized in communication via text and social media. This phenomenon is also known as textisms, textese, text-speak, or texting language (Omar, 2012).

Standard English. English that with respect to spelling, grammar, pronunciation, and vocabulary is substantially uniform though not devoid of regional differences, that is well established by usage in the formal and informal speech and writing of the educated, and that is widely recognized as acceptable wherever English is spoken and understood (Standard English, n.d.).

Textese. The language utilized in text messages characterized by the abbreviations, textisms, and lack of punctuation and capitalization (Kemp & Bushnell, 2011).

Textisms. Words incorporated into writing as a form of shorthand and are most frequently implemented in texting and social media. Textisms and text language are a merger of written and spoken language that includes abbreviations, acronyms, and slang (Durkin et al., 2011).

Text message. By definition, “text messaging, or more specifically, SMS (Short Message Service) texting enables text messages up to 160 characters long to be sent and received by

mobile phones” (Buczynski, 2008, p. 263). Recent literature supported the existence of a phenomenon with texting through reports on text message studies (Harris Interactive, 2008).

Text messaging or *texting*. The sending of short typed messages between mobile phones using the Short Message Service (SMS) and was a feature of most mobile phones since the late 1990s (Plester et al., 2011). This study used the terms *text messaging* and *texting* interchangeably to refer to the format and language variety, as well as the act of sending the communication, while the term *text message* referred to the individual message sent.

Summary

This chapter provided background on the potential influence that text messaging may have on student academic writing proficiency. Research on the history of texting and writing assessments was presented, as was the statement of the problem. The purpose of this study was stated, and the research questions were defined. An overview of the meta-analytic method of research, including the benefits and limitations of meta-analysis were described, and the relevance of the study was explained. Lastly, definitions relating to text messaging, writing assessment, and meta-analysis were presented.

CHAPTER II

LITERATURE REVIEW

Research efforts demonstrating the relationship between text messaging's influence on student literacy measures began approximately 15 years ago, when text messaging services became less expensive and more commonly used among students. Noting that some studies offered more than one data set using separate populations of students, some research showed positive relationships between text messaging and writing-related assessment outcomes in English-speaking students (Bushnell et al., 2011; Cingel & Sundar, 2012; Drouin, 2011; Durkin et al., 2011; Kemp, 2010, Kemp & Bushnell, 2011; Kemp et al., 2014; Plester et al., 2008, 2009). Other studies showed negative relationships between text messaging and writing-related assessment measures in English-speaking students (De Jonge & Kemp, 2012; Drouin & Davis, 2009; Grace et al., 2014; Varnhagen et al., 2010), and one study showed no correlation at all between text messaging and writing-related assessment outcomes (Wood et al., 2011). This necessitated the need for research and analysis that can more clearly determine whether text messaging impacts performance assessments outcomes in constructs used to evaluate academic writing. This review discusses text messaging and writing-related assessment outcomes.

Standard English

The perception that text messaging may lead to students' misuse of Standard English language in formal writing environments is based on the assumption that distinctive linguistic features exist between textese and Standard English. It should be noted that the "standardization" of a language is a historical process that is always in progress; in fact, the only fully standardized

language is a dead language (Milroy & Milroy, 1999). The important difference between Standard and non-standard English is that Standard English is generally accepted as the correct or most appropriate form of English to use in formal settings, while non-standard English, such as textese, is not (Campbell & Mixco, 2007).

Crystal (2008) stated that Standard English is best defined as the following:

- Focused on grammar, vocabulary, and orthography (spelling and punctuation).
- Carries the most social prestige, which is recognizable to well-educated citizens.
- Used in community institutions, such as government, courts, and schools.
- Understood by many, produced by few; most people reserve Standard English for particular writing tasks, such as formal business writing. Found mostly in print.
- Unlike other “dialects,” Standard English has no local base.

Whether written or spoken, Standard English today is not the same as it was a century ago, and it will be different again a century from now (Crystal, 2008). Huddleston and Pullum (2002) used the term ‘snapshot’ to refer to instances where the definition of a term might change over time. In fact, the changes to Standard English are so slow that from year to year we hardly notice it happening (Birner, 2012); however, the growing pains associated with the ongoing evolution of language are noticed frequently. For example, Shakespeare’s writings from the 16th century can be difficult for students to understand, but many manage to make meaning. Reading Chaucer’s *Canterbury Tales*, written 2 centuries earlier, creates more difficulty for students, and reading *Beowulf*, written over 500 years earlier is like reading a different language entirely (Birner, 2012). Standard English also differs by location and even at the same moment in time, it is not identical everywhere. For the purposes of this study, Standard English will denote Standard English conventions used in the United States.

Characteristics of Text Messaging

While Standard English is identified primarily by proper vocabulary, grammar, and spelling, textese is most often identified as something different, something inferior (Johnson, 2012). Both Standard English and textese are dialects, or socially distinctive varieties of language, each characterized by a particular set of words and grammatical structures (Crystal, 2008). In contrast to ‘standard’ language, which is prestigious, correct, uniform, and follows the rules of grammar, dialects generally lack prestige, are seen as incorrect, substandard, and fail to obey grammatical rules (Hock & Joseph, 2009). Lenhart (2012) explained that the dialect of text messaging is often seen as having a corrupting influence on the presumed ‘standard’ of formal written Standard English. Table 1 shows the characteristics of textese.

Table 1

Characteristics of Text Messaging Language

No.	Characteristic	Example
1.	Shortenings	<i>bro</i> for <i>brother</i> <i>tues</i> for <i>Tuesday</i>
2.	Contractions	<i>plz</i> for <i>please</i> <i>watcha</i> for <i>what are you</i>
3.	G-clippings	<i>goin</i> for <i>going</i> <i>doin</i> for <i>doing</i>
4.	Other clippings	<i>hav</i> for <i>have</i> <i>wil</i> for <i>will</i>
5.	Omitted apostrophes	<i>cant</i> for <i>can't</i> <i>dads</i> for <i>dad's</i> <i>ur</i> for <i>your/you're</i>
6.	Omitted articles	Omission of both <i>the</i> and <i>a/an</i>
7.	Acronyms and initialisms	<i>ATL</i> for <i>Atlanta</i> <i>ttfn</i> for <i>ta ta for now</i>

Table 1 (con't)

No.	Characteristic	Example
8.	Symbols and emoticons	@ for <i>at</i> & for <i>and</i> # for <i>number</i> ☺ or ♥
9.	Letter and number homophones	2 <i>moro</i> for <i>tomorrow</i> b4 for <i>before</i>
10.	Non-conventional spellings	f <i>one</i> for <i>phone</i> r <i>ite</i> for <i>right/write</i> s <i>kool</i> for <i>school</i>
11.	Informal tone and register	Informal address such as <i>Hi</i> instead of <i>Dear</i> and slang terms used
12.	Lack of capitalization	At the beginning of a sentence or for proper nouns
13.	Lack of punctuation	Missing commas and full stops

The characteristics that define text messaging are also the examples of non-standard English. Any one of these categories could be an independent variable on its own; however, for the purposes of this review, it was understood that a textese represents any or all of the characteristics listed in Table 1. Although the studies used in this study may contain data relating to the type of text message sent or received, this analysis only measured text messaging by frequency of occurrence.

Writing Evaluation

Performance results from the 2011 NAEP Writing Assessment provided the largest and most recent nationally representative assessment of students' writing proficiency. In 2011, students in grades 8 and 12 were assessed, and their results were reported as average scale scores and as percentages of students performing at three achievement levels: *basic*, *proficient*, and *advanced* (National Center for Education Statistics, 2012). These results indicated that

approximately two-thirds of the nation’s 8th and 12th grade students performed at a basic level writing proficiency, meaning that these students had only partial mastery of the knowledge and skills that are fundamental for proficient writing at these grade levels (Bauman & Davis, 2013).

Beginning in late 2016 and ending in early 2017, students in grades four and eight will be administered the 2017 NAEP Writing Assessment, and though some areas of the test have changed since 2011, the manner in which student writing will be evaluated remains the same (U.S. Department of Education, 2016). For this reason, the 2011 NAEP Writing Assessment standards provided a framework for criteria when searching for studies. Studies that correlated text messaging engagement with a standardized measure of one of the NAEP’s domains of evaluation were sought. The domains included (a) Development of Ideas, (b) Organization of Ideas, and (c) Language Facility and Conventions (National Assessment Governing Board, 2010). Table 2 presents these three domains and the important criteria within each domain. Analyzing studies that correlated text messaging with domains and criteria of 2011 NAEP standardized writing assessment will allow for more studies and data to be included.

Table 2
Assessment Criteria for 2011 NAEP Writing Test

Broad Domain	Specific Criteria Evaluated in Regard to Purpose and Audience
Development of Ideas	Depth and complexity Approaches to thinking and writing Details and examples
Organization	Text structure Coherence Focus
Language Facility and Conventions	Sentence structure and sentence variety Word choice Voice and tone Grammar, usage, and mechanics (capitalization, punctuation, and spelling)

Not all of the criteria within the writing domains are directly related to the language of text messaging, though. In order to search for studies, the characteristics of textese were aligned with the domains and criteria of the NAEP Writing Assessment. This representation showed that although textese has the potential to affect performance assessment outcomes, the influence is only in the domain of language facility and conventions. Figure 2 provides a visual representation of how the characteristics of textese align with the NAEP Writing Assessment domains of evaluation.



Figure 2. Evaluative domains of writing potentially affected by textese. Adapted from “Writing Framework for the 2011 National Assessment of Educational Progress,” by the National Assessment Governing Board, Washington, DC: U.S. Department of Education and adapted from Crystal, D. (2008). *Txtng: The gr8 db8*. New York: Oxford.

Figure 2 shows that textese does have the potential to impact writing assessment outcomes. Returning to the first question that examines the impact of students’ use of text

messaging on their academic writing, as shown on performance assessment outcomes related to specific writing standards, we can see that one domain, language facility and conventions, contains criteria that is affected by characteristics of textese (Crystal, 2008; National Assessment Governing Board, 2010). Also important to note is the fact that language facility and conventions are only one of three domains of writing evaluation. This should, in effect, lessen any impact that text messaging could have upon writing assessment outcomes. Language facility and conventions are comprised of four specific measures of evaluation, and these are detailed below.

Language Facility and Conventions

Language facility and conventions refers to stylistic effectiveness and grammatical clarity in the ways writers express ideas to the reader (National Assessment Governing Board, 2010). Good writers make many choices about language use. They decide what kinds of sentences to use and how to construct sentences to clearly convey relationships among ideas. Strong writers also arrange these sentences to enhance the organizational qualities of their writing, and they choose particular words and alter how emotion and voice are expressed to clearly and effectively communicate meaning (National Assessment Governing Board, 2010). All of this is done to maintain the reader's interest. Lastly, good writers adhere to established rules of communication to ensure understanding and avoid distractions.

Sentence structure and variety, word choice, voice and tone. Effective writers craft the structure and variety of their sentences to clarify their topic, to effectively accomplish the purpose of the task, and to engage the reader. Strong sentence structure can also enhance the development and organization of ideas and is a device used by writers to emphasize ideas within a sentence (National Assessment Governing Board, 2010). Good writers are also able to decide what words will most precisely and clearly express their ideas, as well as what words will

support their purpose for writing. They also consider their relationship with the reader, choosing words that encourage a reader to connect to their ideas and intentions. Lastly, good writing also involves adapting voice and tone depending on the purpose, audience, and topic of a particular writing task (National Assessment Governing Board, 2010). That means, successful writers recognize the context of the writing situation, the audience they are writing for, and intentionally alter their style and language choices to achieve this goal. Two ways this is achieved are through voice, the writer's ability to convey a personality or attitude in language, and tone, the writer's attitude toward the topic or audience (Weigle, 2002). The 2011 NAEP Writing Assessment evaluated how these stylistic choices helped the writer achieve the purpose of the writing task and communicate effectively to the audience, and this is one of the areas that text messaging could possibly affect. Informal tone and register is one of the characteristics of textese, and the misuse of tone and register could have an effect on the assessment in this domain of writing evaluation.

Conventions: grammar, usage, and mechanics. The National Assessment Governing Board (2010) defined grammar, usage, and mechanics as the following:

- Grammar: The system through which a given language is ordered according to an agreed-upon set of internal rules.
- Usage: Established conventions of written language commonly used in forms of communication.
- Mechanics: The conventions of capitalization, punctuation, and spelling (p. 60).

Effective writers have a command of grammar, usage, and mechanics so that only minimal errors, if any, are present in their writing (National Assessment Governing Board, 2010). Just as the variety, severity, and pervasiveness of errors in grammar, usage, and mechanics can distract readers and make it difficult to understand the writer's meaning, correct use of language can facilitate understanding by allowing the reader to focus on the writer's thoughts and ideas

(Jeffery, 2009). As previously shown, the remaining 12 characteristics of textese (Crystal, 2008) all have the potential to affect outcomes in grammar, usage, and mechanics, which are part of the language facility and conventions domain of writing assessment.

Standardized Assessments Used to Measure Written Language Proficiency in Target Studies

The British Ability Scales (BAS)

The BAS is a battery of individually administered tests of cognitive abilities and educational achievement. The BAS include many subtests, but the tests that directly correlate with writing proficiency include the Single Word Spelling Test (SWST) and the British Spelling Test Series (BSTS). The SWST comprises a series of nine standardized tests designed to assess spelling attainment, and the BSTS also includes spelling test series that assesses spelling ability through questions and tasks (Elliott et al., 1997).

The Cognitive Abilities Test (CogAT)

The CogAT is a measure of a student's potential to succeed in school-related tasks. It is not a tool for measuring a student's intelligence; rather, the CogtAT measures the reasoning skills that have developed during a student's educational career, even if the skill was not specifically taught. CogAT scores are measured as

- verbal (verbal classification, sentence completion, and verbal analogies),
- quantitative (quantitative relations, number series, and equation building), and
- non-verbal (figure classification, figure analogies, and figure analysis).

The verbal measures directly relate to writing proficiency, as they provide information about student grammar and usage abilities (Lohman & Hagen, 2002).

Test for Reception of Grammar (TROG)

The TROG also measures students' understanding of grammatical contrasts through assessing grammatical comprehension by measuring understanding of 20 constructions two times each using different test stimuli (Bishop, 1989).

Woodcock Johnson Tests of Achievement (WJ)

The WJ tests of achievement comprise many subtests; however, only spelling scores directly relate to writing outcomes. The examiner dictates increasingly difficult spelling words to the child, who writes them down on the paper provided. Contextual sentences are provided (Woodcock et al., 2001).

Wide Range Achievement Test (WRAT)

The WRAT measures an individual's ability to read words, comprehend sentences, spell, and compute solutions to math problems (Wilkinson, 1993). For the purposes of this study, the spelling achievement scores were the only subtest considered, as spelling is directly related to the writing domain of language facility and conventions.

Potential Influence of Text Messaging on Student Writing

Returning to the research questions posited in Chapter I, the *learning* examined in this study was the active and contextualized process of constructing *writing* knowledge. Based on the constructivist theory, *knowledge*, or process of learning, is influenced by the personal experiences and connections with the environment outside of the self, which in this study, refers to students' use of *text messaging*. Constructivism states that learning is an active and contextualized process of constructing knowledge, and knowledge is created based on personal experiences and connections with the environment outside of the self (Stahl, 2011). Under the principles of the constructivist theory of learning, students' informal, out-of-school text

messaging will influence students' formal writing knowledge. This influence may show positive correlations (increased text messaging results in increased writing-related assessment outcomes), or the influence may show negative correlations (increased text messaging results in decreased writing-related assessment outcomes). Regardless of the eventual findings, students' previous knowledge and experiences are the starting point for new learning (Pressley, Harris, & Marks, 1992).

Constructivists stress that real understanding can occur only when children participate fully in their own learning because full participation is believed to lead to deeper and richer understanding and use of knowledge (Harris & Graham, 1994). The constructivist theory of learning comprises both cognitive and social constructivism, which were respectively developed by Jean Piaget and Lev Vygotsky (Cruickshank, Bainer, & Metcalf, 1999). Both Piaget and Vygotsky viewed the development of knowledge as a complex interaction between the person and the environment, though Piaget focused on the mental activity of the learner in the environment, while Vygotsky focused on the social interactions of the learner. In Piaget's approach the teacher's role is to create situations in which learners can change, enrich, and link their previous and current knowledge (Fosnot, 1996). Vygotsky proposed that knowledge and meaning are actively and collaboratively constructed in a social context mediated by discourse (Van der Veer & Valsiner, 1991). Perl (1994) added to this theory by citing Brodkey (1987) to explain that writing should not be understood "as a room in which a writer is isolated and alone, but as a room in which many voices reside: those that both shape the writer and to which he or she responds in return" (p. xvi). Contemporary composition scholars advocate writing pedagogies that range beyond the any singular process or theory for composition; there exists no one-size-fits-all definition of good writing (Vandenberg, Hum, & Clary-Lemon, 2006).

Relevant to this study regarding the relationship between text messaging and writing-related assessment outcomes, Vygotsky suggested that language forms the foundation of an individual's conceptual development of the world, as well as the individual's communicative development with others in the world (Wertsch & Sohmer, 1995). The importance of language goes beyond language as communication; the use of and exposure to language affects the ways in which a person interprets the world. According to Vygotsky, language serves as a psychological tool that causes a fundamental change in mental functions. Signaling, significative, social, individual, communicative, intellectual, nominative, and indicative are all functions of spoken language, according to Vygotsky (Wertsch & Sohmer, 1995). Furthermore, Vygotsky argued that the path between objects and thought is mediated by other people through the use of signs or symbols of the language (Van der Veer & Valsiner, 1991). As such, learning is both a human's growing domination over nature through the invention of tools and the perfection of technology, as well as a human's gradual control of the self through the invention of the cultural technique of signs (Van der Veer & Valsiner, 1991, p. 220).

Social learning theory contends that although learning depends on the individual who processes the information, thinking itself derives from knowledge and skills developed in formal instructional settings, more than on general conceptual competencies that result from one's experiences and innate abilities (Fosnot, 1996). Learning happens in the mind of the student, though there must also be a structured setting for this learning to happen. This disallows for the notion that people can learn intense and involved material from simply observing the world as they pass through it.

Moshman (1982) identified three types of constructivist learning paradigms: exogenous constructivism, endogenous constructivism, and dialectical constructivism. Exogenous

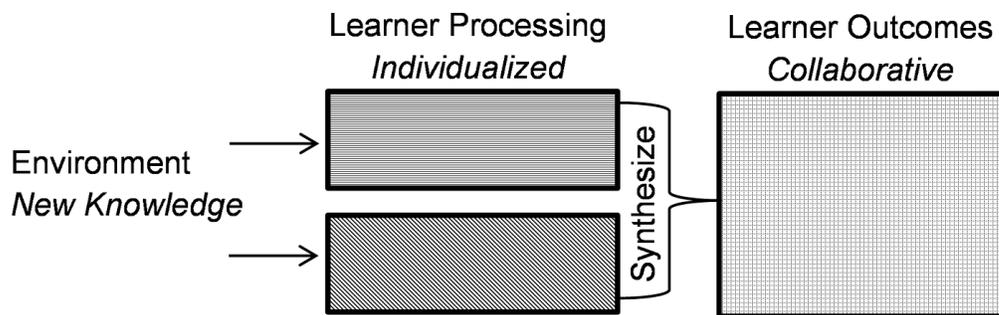
constructivism suggests that the external world influences beliefs through experiences, exposure to models, and teaching. Endogenous constructivism suggests that knowledge comes from both a learner's environmental interactions and that learner's pre-existing understanding of the world (Moshman, 1982). Lastly, like exogenous and endogenous constructivism, dialectical constructivism also begins with the precept that knowledge comes from both environmental interactions and one's pre-existing understanding of the world. Endogenous constructivism goes one step further than exogenous constructivism by establishing cooperative, social interaction as a necessary step in gaining knowledge. Dialectical constructivism also posits the need for social interaction in learning; however, instead of the social interaction being cooperative, or adding to one's knowledge or outcome, the dialectical construct asserts that the social interaction is in itself a part of the process that produces individual knowledge (Moshman, 1982). That is, instead of viewing the social interaction as simply a means to facilitate and transfer information to one another, the dialectical paradigm views the social interaction as a foundation of the learning process itself (Moshman, 1982).

In terms of text messaging's influence on students' writing-related assessment outcomes, Moshman's (1982) theory indicates that the social interaction of one student sending and receiving text messages with another student is the very foundation of the learning process. Regardless of whether positive or negative correlations between the activity and the outcome are found, dialectical theory stresses that this interaction is where learning is found. Once the social interaction occurs, the collaborative process also occurs, allowing the learners to synthesize their environmental and socially constructed knowledge, and then develop a new knowledge concept not accessible prior to collaborative interaction (Stahl, 2011). Dialectical constructivism suggests that the two students who watched the lecture and shared their ideas with one another will then

reshape their original ideas and recreate a new learning experience. Learners will do more than impart their knowledge upon others. In the process of interacting, learners will also reconfigure and refine their individual knowledge because of the collaborative effects of the interactive experience. The term “dialectical” constructivism recognizes the importance of dialogue in the learning process. Though discourse and social interaction may be the means by which knowledge is delivered, more importantly, according to the dialectical constructivist paradigm, discourse and social interaction are integral to the very process through which knowledge is attained (Moshman, 1982).

Figure 3 shows the dialectical constructivist model. The source of knowledge is both the environment and a synthesis of the social interactions which enable individualized learning. The result is a collaborative product.

Dialectical Constructivism



Learners negotiate new knowledge with pre-existing knowledge; social interaction synthesized; new understanding created.

Figure 3. Dialectical constructivist paradigm. Adapted from Stahl, G. (2011). *Theories of cognition in collaborative learning*. New York, NY: Taylor & Francis.

Through the lens of dialectical constructivism, individual knowledge is derived from the environment and social interactions perform both cooperative and collaborative functions in the learning process. For the purposes of this study, the dialectical constructivist model provided a

paradigm from which the variables of text messaging and academic writing proficiency may be examined. The source of academic writing knowledge occurs in the formal, in-school environment of the classroom, yet for many students, the act of writing happens during the social interaction of text messaging, which is an informal, out-of-school activity (Crystal, 2008). Constructivist theory suggests that students will negotiate their formal writing knowledge alongside their pre-existing writing knowledge, regardless of whether educator acknowledgement occurs (Fosnot, 2013). Dialectical constructivism suggests that educators acknowledge the dichotomous nature of the messages students receive about writing and composition (Moshman, 1982). On the one hand, teachers strive to inform students of the academic writing process, yet on the other hand, students frequently and successfully communicate through the informal writing of text messaging. Rather than disregard the invisible back and forth occurring in students' minds as they work to determine formal from informal, academic from colloquial, teachers can actively foster growth and learning. By simply allowing students the opportunity for social interaction with deliberate collaborative tasks regarding the differences and similarities between text messaging and academic writing, teachers may be able to strengthen individual learning.

Whether this meta-analysis reveals positive or negative correlations between text messaging use and writing-related assessment outcomes, the impact on teachers, school leaders, and parents remains. If an increase in text messaging use correlates to an increase in writing-related assessment outcomes, then teachers have a powerful teaching tool at their disposal. If the findings of the meta-analysis show that an increase in text messaging use correlates to a decrease in writing-related assessment outcomes, then teachers are aware of at least one possible cause of

poor writing assessment outcomes, and they can then work to address and correct the negative influence.

Descriptive Review of Studies

As stated earlier in this chapter, the use of text messaging does have the potential to impact writing assessment outcomes related to specific writing standards; however, only one domain of writing evaluation, language facility and conventions, presented any direct effects of text messaging use. This following review of studies focused on evaluating the literature regarding text messaging and grammar and spelling proficiency outcomes. Because this study analyzed measures used to evaluate writing-related standards within separate populations, some studies provided more than one set of data and were treated separately. The studies with K-12 populations are presented first. K-12 studies indicating positive correlations are presented first, in order of publication date, followed by university undergraduate indicating positive correlations, in order of publication date.

Influence of Text Messaging on Writing-related Outcomes in K-12 Students

Positive correlations. Plester et al. (2008) reported on two studies investigating the relationship between texting and literacy. In Study 1, 60 British middle school students ($M = 11.67$ years) translated sentences from Standard English into textese and vice versa. Plester et al. correlated errors in general grammar and usage with text messaging engagement. The *CogAT* measuring verbal and non-verbal reasoning yielded participants' general ability in this area. There was a significant positive correlation ($r = .35$) between grammar and usage skills and text message density, indicating that students who could translate language shortcuts into Standard English were more competent users of grammar and usage constructs. In Study 2, 34 middle school students ($M = 11$ years) translated an exchange from Standard English into textese and

vice versa. Spelling proficiency was assessed through the *BAS II*. There was a significant correlation ($r = .52$) between spelling ability and proficiency on the translation task, indicating that students who could translate and understood language shortcuts were more competent in spelling than those students who could not translate back and forth.

Plester et al. (2009) studied the relationship between textisms and literacy achievement with 80 British middle-school aged children ($M = 10.6$ years). Their knowledge and use of textisms was measured by eliciting spontaneous text messages, where they had to pretend that they were in different situations. Density of textism use was established by calculating the ratio of textisms to total words used. The *BAS II* was used to assess spelling proficiency. Plester et al. found positive a correlation ($r = .70$) between textism density and spelling ability, and even when controlling for individual differences in age, vocabulary, phonological awareness, non-word reading ability, short-term memory, and length of time owning mobile texting device, the extent of children's textism use predicted their spelling ability. Acknowledging that correlational analyses cannot lead to a conclusion that experience and skill with texting actively contributes to children's spelling ability, Plester et al. asserted that the experience and skill of text messaging can contribute to the prediction of their spelling ability on other measures of students' spelling proficiency.

Bushnell et al. (2011) studied the relationship between texting and spelling with 225 Australian middle and high school students ($M = 11.5$ years). Questionnaires measured their texting-related behaviors and attitudes. Their knowledge and use of textisms was assessed with a translation task in which they had to rewrite a list of conventionally spelled words as they would in a text message and spelling ability was measured with the *WRAT*. On average, the students wrote about half of the words as textisms and the rest in Standard English. Even students who

reported not sending text messages on a daily basis produced a considerable number of textisms, but students who did send text messages on a daily basis produced significantly more. There was a significant positive correlation ($r = .27$) between spelling skills and the proportion of textisms produced. This indicated that the greater a student's spelling ability, the more textisms he or she produced. Bushnell et al. concluded that this "speaks against media claims that text messaging has a detrimental effect on spelling" (p. 34).

Durkin et al. (2011) explored the relationship between textism use and spelling ability in high school students ($M = 17$ years). Forty-seven students were each interviewed about texting frequency and then asked to send a text message in reply to one sent by the experimenter. Durkin et al. found a significant positive correlation ($r = .77$) between the spelling assessment outcomes on the *WRAT* and textism density and the number of types of textisms used. They concluded that spelling ability has a positive correlation to the choice to return a text message, the length of a message, and the use of textese. Adolescents with increased spelling proficiency were more likely to return a message, send significantly longer messages, and use more textisms and more different types.

In investigating the association between texting and spelling outcomes, Kemp and Bushnell (2011) looked at the effects of texting method (predictive and multi-press) and experience. Eighty-six Australian middle-school students ($M = 11.5$ years) read and wrote text messages in Standard English and textese on a mobile phone and were assessed in spelling ability on *WRAT*. Students using the predictive mode turned out to be faster at writing and reading messages than those using the multi-press mode. Texting experience increased text messaging writing but not reading speed, and assessment outcomes did not differ significantly depending on the texting method. There was a significant positive correlation between text

messaging writing speed and spelling proficiency ($r = .21$). Kemp and Bushnell explained this positive relationship stating, “. . . experience with textese can reflect or even enhance children’s traditional literacy abilities, in contrast to media concern, which seems to have been based on speculation or at best on anecdotal evidence” (p. 26). The students’ writing was found not to be overrun with textisms, and they used very few textisms in the Standard English messages.

Cingel and Sundar (2012) investigated whether increased use of text messaging produced greater reliance on textisms to the point of altering students’ sense of written grammar. The *CogAT* grammar assessment was administered to 228 American middle school students ($M = 12.48$ years), and they also completed a self-report survey of texting behaviors and message characteristics, including usage, attitudes toward text messaging, and textual adaptations. The results of this study showed a positive relationship between text messaging and adolescent grammar skills ($r = .34$). First, adolescents found text messaging to be a useful technology and used the technology more often and, overall, the participants scored quite high on both usage measures included in the survey (Cingel & Sundar, 2012). Furthermore, findings indicated that those who perceived text messaging to be useful for communications reported sending and receiving more textual adaptations. Lastly, the utilization of these textisms had more influence on the students’ grammar scores than their grade level (Cingel & Sundar, 2012). This study lent support to other findings suggesting positive correlations between texting and writing outcomes.

Kemp et al. (2014) examined whether the grammatical violations made by 243 British primary, secondary, and post-secondary students in their text messages were related to poorer proficiency on tasks of grammatical knowledge, including translating grammatically unconventional text messages into Standard English. The results from 89 primary school students ($M = 9.92$ years) and 84 secondary school students ($M = 12.92$ years) are discussed

here, and post-secondary school populations are discussed in the university undergraduate section of this review. Students completed questionnaires that included how long they had owned a mobile phone, their current phone's keyboard type and use of predictive text, the frequency with which they sent text messages, and reasons for and preferences about writing text messages. Then, participants completed two standardized grammar tests on the *TROG-2*. The first task assessed students' understanding of spoken grammar. For each item, participants were required to choose one of four pictures that corresponded to a sentence read out by the researcher. The second task tested participants' ability to choose the grammatically appropriate one of two alternative pseudo-word spellings. For primary school students, the outcomes showed a significant positive correlation ($r=.45$) between grammar assessment outcomes and self-reported text messaging use. For secondary school students, the correlation was also positive ($r=.14$), though less significant. The researchers concluded that using unconventional grammar when texting was not a consistent sign of poor grammatical abilities (Kemp et al., 2014).

No correlations. Wood et al. (2011) conducted an intervention study with 114 British elementary-school students ($M = 9.83$ years) to investigate the direction of any relationship between texting and literacy. This study differed from other studies in that none of the participants had ever owned a mobile phone, but it is important to note that Wood et al. did not consider whether the students had ever had exposure to text messaging. Participants were divided randomly into an experimental group and a control group. After receiving a brief explanation about how to use it, those in the experimental group were given access to a mobile phone which they could use just for texting in the half-term break and on weekends for 10 weeks. Their text messages were transcribed exactly as written on the mobile phones. The students completed the *BAS II* pre- and post-tests in spelling. No significant differences ($r = .04$) were found between the

experimental and control group regarding their literacy attainment during the experiment. Wood et al. concluded that having access to a mobile phone for texting during several weeks neither adversely nor favorably affected literacy skills; however, they suggested that this might be attributed to the duration of the study or to the restricted access to the mobile phones.

Negative correlations. Varnhagen et al. (2010) conducted a study on the relationship between texting and spelling abilities. Thirty-six high school students ($M = 14.42$ years) saved all computer-based instant message conversations for 1 week. Then, the researchers administered the *WRAT-3* spelling subtest to the participants. The digitally recorded words were sent individually over the internet through the same instant messaging program the participant had used to record his or her instant messages. The participants listened to each word-context sentence through an audio file, typed the spelling on a word pad document with spell check turned off, then sent the word list via email or instant messaging to the researchers. The researchers collected and analyzed text message data from the students' messages, such as acronyms (e.g., *lol*) and word combinations (e.g., *wanna*), and this was correlated with *WRAT-3* spelling subtest results. The results indicated a negative correlation ($r = -.42$) between text messaging and spelling abilities.

De Jonge and Kemp (2012) conducted a study on the relationship between texting and literacy. One hundred five Australian high school students ($M = 17$ years) translated sentences from Standard English into textese. They also completed the *WRAT* spelling test. The results indicated that textism use (the number of messages sent per day, the textism density, and the number of textism categories used) had a significant negative correlation ($r = -.32$) with spelling. De Jonge and Kemp argued that frequent texting may interfere with literacy development or

provide an opportunity for young people who are less competent in literacy to mask poor spelling.

Influence of Text Messaging on Writing-related Outcomes in Undergraduate Students

Positive correlations. Kemp (2010) analyzed the use and understanding of textisms as related to literacy skills in 58 Australian 1st-year university students ($M = 22.2$ years). Besides completing questionnaires and a standardized spelling test, participants had to read and write text messages in Standard English and in textese on a mobile phone. The results showed that texting frequency had a positive correlation ($r = .35$) to spelling abilities, as measured on the *WRAT*. Kemp concluded that those with better spelling skills were more efficient at composing and deciphering text messages or, conversely stated, that those who were fluent with text messaging had better spelling skills. There was hardly any intrusion of textisms into the Standard English messages, which suggested that students were capable of limiting their textism use to appropriate contexts.

Drouin (2011) examined the relationship between reported frequency of texting, use of textese, and literacy in a sample of 152 American post-high school students ($M = 21.2$ years). The spelling subtest of the *WJ III* achievement test was used to assess students' spelling skills. Drouin found significant positive correlations ($r = .71$) between spelling and texting frequency, indicating that students who sent more text messages had higher spelling abilities.

As stated previously, Kemp et al. (2014) examined whether the grammatical violations made by 243 British primary, secondary, and post-secondary students in their text messages were related to poorer proficiency on tasks of grammatical knowledge, including translating grammatically unconventional text messages into Standard English. Seventy undergraduate university students ($M = 20.5$ years) completed questionnaires that included how long they had

owned a mobile phone, their current phone's keyboard type and use of predictive text, the frequency with which they sent text messages, and reasons for and preferences about writing text messages. The participants then completed two standardized grammar tests on the *TROG-2*. The first task assessed students' understanding of spoken grammar. For each item, participants were required to choose one of four pictures that corresponded to a sentence read out by the researcher. The second task tested participants' ability to choose the grammatically appropriate one of two alternative pseudo-word spellings. The results showed a positive correlation ($r = .28$) between grammar assessment outcomes and self-reported text messaging use. The researchers concluded that using unconventional grammar when texting was not a consistent sign of poor grammatical abilities (Kemp et al., 2014).

Negative correlations. Drouin and Davis (2009) studied the effects of text messaging on spelling ability in 34 American undergraduate university students ($M = 21.8$ years). Experimental methods measured their textism use in different contexts (by writing formal vs. informal emails), textese proficiency (by translating Standard English into textese), familiarity with textese (by translating textese into Standard English), and misspellings of target words commonly abbreviated in textese such as "you're," "to," "two," and "too" (by recording spelling errors for these words in translating into Standard English). The spelling subtest of the *WJ III* achievement test was used to assess students' spelling skills. There were no significant differences between students who indicated that they used textese and those who did not in their literacy scores or misspellings of words regularly abbreviated in textese. Nevertheless, a survey revealed that about half of the students thought that textese hindered their ability to remember Standard English. Drouin and Davis concluded that their findings are conflicting: although no correlation was

found between literacy and using textese, many students' perceptions of the effect of texting on literacy were negative.

Grace et al. (2014) investigated the correlation between text messaging and literacy in 150 1st-year undergraduate students ($M = 22.50$). Students provided samples of their recently sent text messages, filled in a short questionnaire, and completed a spelling task. The students then completed more tasks, including the *WRAT*. The results showed a negative correlation ($r = -.10$) between spelling proficiency and texting-related measures, indicating that text messaging has a negative influence on spelling.

Summary

This chapter provided a theoretical framework for the study. The formal register of Standard English language was discussed, as was the informal register of text messaging, known as textese. The three domains of writing assessment, according to the standards of evaluation established by the National Assessment Governing Board (2010) were displayed, and the areas within language facility and conventions that were shown to be potentially affected by textese use were presented. A descriptive review of previous research was presented to show findings that reflected positive, negative, and no associations between texting and writing-related assessment outcomes among K-12 and university undergraduate students.

CHAPTER III
METHODOLOGY
Research Design

Despite a growing body of literature, the impact of text messaging on student writing has yet to be meta-analyzed by researchers. Meta-analysis refers to a set of statistical procedures that are used to quantitatively aggregate the results of multiple primary studies to arrive at an overall conclusion or summary across these studies (Borenstein et al., 2009). Lipsey and Wilson (2001) suggested the following basic steps in conducting a meta-analysis.

1. Problem definition— topic, empirical relationships of interest, type of research, and acceptable methods
2. Defining the population of relevant studies and determining eligibility criteria
3. Locating and retrieving eligible studies—attempt to obtain entire population, published and unpublished
4. Developing and testing a coding scheme and coding manual
5. Coding eligible studies; constructing a database
6. Statistical analysis of the meta-analytic data
7. Interpretation and reporting of analysis results

Because standardized writing assessments remain on the horizon, and student text messaging use shows no sign of decline, it is imperative that the relationship between text messaging and academic writing abilities be examined. By using a systematic process for reviewing available research regarding text messaging and writing, the results can then be meta-

analyzed. These results can guide parental choices, teaching practice, and policy decisions, as well as be utilized for future research. This study was not considered to be research involving the use areas of human subjects because all data used in this study came from previous research; therefore, The University of Alabama's Internal Review Board (IRB) determined that IRB approval for this study was excluded from their review (see Appendix A). Lastly, the meta-analysis calculations were conducted using Comprehensive Meta-Analysis (CMA) (Comprehensive Meta-Analysis (Version 3) [Computer Software].)

Research Questions

As indicated in Chapter II, the 2011 NAEP's criteria for evaluating student writing shares commonalities with the writing constructs vulnerable to the influence of textese. A descriptive review of the studies related to text messaging and writing domains was conducted, and the assessment outcomes (dependent variables) related to student writing proficiency that were most likely to be influenced by text messaging (independent variable) were reduced to their most basic parts. The review of literature showed that writing domains and criteria associated with the development and organization of ideas are not directly associated with characteristics of textese; however, the domain of language facility and conventions is directly related to characteristics of textese. These included general grammar usage and spelling proficiency, as measured with standardized assessment instruments.

The research questions defining this meta-analysis include the following:

1. What is the impact of students' use of text messaging on their academic writing, as shown on performance assessment outcomes?

2. Does the impact of students' use of text messaging on their academic writing as shown on performance assessment outcomes differ across educational levels (i.e., K-12 vs. undergraduate college)?

3. Does the impact of students' use of text messaging on their academic writing as shown on performance assessment outcomes differ across domains of writing (i.e., grammar vs. spelling)?

The association between the independent variable and the dependent variable(s) may be positively associated, or they may be negatively associated. For instance, if, as the independent variable of text messaging use increases, the dependent variable of spelling assessment outcomes also increases, a positive relationship is indicated. If, as the independent variable of text messaging use increases, the dependent variable of spelling assessment outcomes decreases, a negative relationship is indicated (Moola et al., 2015).

Variables Examined

Dependent Variables

The dependent variables in this study were assessment measure outcomes related to standards of writing evaluation. The instruments used to measure assessment outcomes were chosen based on the review of literature conducted in Chapter II because these instruments specifically measured constructs directly related to writing evaluation, according to the 2011 NAEP (National Assessment Governing Board, 2010). These variables were also chosen because the review of literature showed these to be constructs of writing that align with characteristics of textese, the informal language associated with text messaging (Wood et al., 2016). These variables have the potential to affect overall writing assessment outcomes. Outcomes relating to the association between general grammar and spelling and school level of students are potential

moderators, as well. These are calculated based on the effect sizes from the studies included in this meta-analysis.

Independent Variable

The independent variable was text messaging. This can be described as use, experience, engagement, frequency, or any other means that assuredly reflects the duration of time spent texting and/or the number of text messages sent and/or received. The effect sizes are the measures of the independent variables' association with the dependent variables. Where effect sizes were not directly given in the study, they were calculated from the available statistical information. If available statistical information was not enough to calculate an effect size, then information from that study was not included in the meta-analysis.

Research Procedure

Search for Studies

The search for studies consisted of searching several databases from the University of Alabama Libraries' electronic resources. The databases searched were Communications & Mass Media Complete (CMMC); Education Sources Information Center (ERIC); Educator's Reference Complete; Elton B. Stephens Co. (EBSCOhost); National Council of Teachers of English (NCTE); ProQuest Research Library, including dissertations and theses; PsycINFO; and SAGE. In addition, a Google Scholar and JSTOR search were conducted, as well.

This systematic process of study retrieval was used to locate all relevant studies investigating the relationship between text messaging and language facility in writing. The two search categories were described as (a) text messaging and (b) writing proficiency. The following key terms were used in the search for studies that contained the data necessary to conduct a meta-analysis: For the text messaging search, the terms: "text messaging," "text

message,” “texting,” “textese,” “SMS,” “SMS messaging,” and “SMSing” were used. For the writing proficiency search, the terms “voice and tone,” “grammar,” “usage,” “mechanics,” “capitalization,” “punctuation,” “spelling,” “shortenings,” “contractions,” “g-clippings,” “other clippings,” “omitted apostrophes,” “omitted articles,” “acronyms,” “initialisms,” “symbols,” “emoticons,” “homophones,” “non-conventional spellings,” and “informal tone” were used.

The keywords from each category were used in various combinations to find studies on the relationship between text messaging and writing-related assessment outcomes. Although text messaging is a fairly new phenomenon, the results from searches using these key terms were did not need to be narrowed by limiting the dates of the studies. Text messaging is a somewhat new means of communication, and studies correlating text messaging to domains of writing evaluation were not numerous.

Criteria for Inclusion of Studies

Studies were selected for review based on several factors. The first criterion applied was to select studies that identified the population as a K-12 student, whose ages ranged from 5-18 years old. University undergraduate students were also included, though this population did not have a standard range of ages, as people of any age enroll as college students; however, ages were still recorded. Because many of these studies originated in English-speaking countries outside of the United States, the reported student grade level does not necessarily correspond to the standard American grade level. For this reason, the reported ages of the students were used in this meta-analysis; however, the results section classified the students’ ages with their corresponding American school-level equivalency. This information was also provided in the definitions section of Chapter I.

This criterion factor resulted in a selection of 23 studies for further analysis. A more in-depth analysis of the 23 studies used the following selection criteria: (a) an effect size indicating the relationship between texting and writing outcome was provided as Pearson's r or (b) statistical information was provided that could be used to calculate an effect size, and (c) the assessment instrument used was a recognized standardized test with data supporting its validity and reliability. Table 3 displays the final results of the search that resulted in 14 studies and 17 sets of data.

Table 3

A List of Studies Included in the Meta-analysis

Researcher	Year	School Level	Assessment Instrument	Writing Standard Evaluated
Bushnell et al.	2011	K-12	WRAT	Spelling
Cingel & Sundar	2012	K-12	CogAT	Grammar
De Jonge & Kemp	2012	K-12	WRAT	Spelling
Durkin et al.	2011	K-12	WRAT	Spelling
Kemp & Bushnell	2011	K-12	WRAT	Spelling
Kemp et al. ¹	2014	K-12	TROG	Grammar
Kemp et al. ²	2014	K-12	TROG	Grammar
Plester et al. ¹	2008	K-12	CogAT	Grammar
Plester et al. ²	2008	K-12	BAS	Spelling
Plester et al.	2009	K-12	BAS	Spelling
Varnhagen et al.	2010	K-12	WRAT	Spelling
Wood et al.	2011	K-12	BAS	Spelling
Drouin	2011	Undergraduate	WJ	Spelling
Drouin & Davis	2009	Undergraduate	WJ	Spelling
Grace et al.	2014	Undergraduate	WRAT	Spelling
Kemp	2010	Undergraduate	WRAT	Spelling
Kemp et al. ³	2014	Undergraduate	TROG	Grammar

Note. Studies with more than one applicable sample size or data set are represented separately.

Coding Protocol

The main purpose of this study was to examine whether there would be a significant relationship between two variables, text messaging and assessment outcomes related to standards of writing, and to see whether the magnitude of the relationships would be different by some other factors (i.e., domains of writing evaluation, school level of students in populations). In order not to lose any important information at the beginning stage of coding, this study coded information on multiple effect sizes per study, if applicable to writing assessment outcome measures.

Study coding. The following results as reported by the studies included in this review were coded (see Appendix B and Appendix C) as the following: (a) study ID, (b) publication date, (c) publication name, (d) sampling method, (e) mean age of students, (f) school level. (g) assessment instrument, (h) writing standard evaluated, (i) N (sample size), (j) *t*-statistic, (k) *F*-statistic, (l) standard deviation, (m) effect size, (n) correlation coefficient *r*.

Effect size coding. The effect size (*ES*) provides a comparable, standardized numeric scale for evidence across disparate studies because the statistic provides a weight of each study's contribution to evidence based on the sample size. There are different effect sizes for different kinds of outcome measures, and there are different statistical methods (e.g., proportional, standardized mean difference, correlation coefficient, and odds ratio) for reaching the same *ES*. The studies included in this meta-analysis directly reported the Pearson product-moment correlation coefficient *r* between text messaging and writing assessment outcome variables. Because the correlation coefficient is a standardized value, the coefficient reported can be used as an effect size index as it is reported in the study (Lipsey & Wilson, 2001):

$$ES_r = r$$

Sample size coding. Sample sizes of the populations provided in the studies were recorded for the purpose of calculating the inverse variance weight. This value is required to calculate the weighted mean of effect sizes as a way to eliminate sampling error. If a study contained two or more samples (e.g., K-12 students and undergraduate students), the number of analysis units from each population and the corresponding r generated from each sample size was recorded. If the study performed analyses based on more than one type of analysis unit (i.e., differing assessment outcome measures), the sample size of that study was recorded based on the associated sample size.

Data Analysis

Weighted Effect Size Means

Different studies have different sample sizes, and the best way to reduce sampling error is to calculate the weighted means (Lipsey & Wilson, 2001). From a statistical perspective, “effect size values based on larger samples are more precise estimates of the corresponding population value than those based on smaller samples” (Lipsey & Wilson, 2001, p. 36). Therefore, the effect size of each study should carry a different “weight” in the sample of research findings to be meta-analyzed. When calculating the mean of the effect sizes, this needs to be taken into account. Although the optimum weights are based on the *standard error* of the effect size, in practice, the standard error for a given statistic is estimated from sample values using a formula derived from statistical theory (Lipsey & Wilson, 2001). This study followed this rule and used the *inverse variance weight* w (the inverse of the squared standard error value) to adjust the value of each effect size ES_i . The following formula was used to calculate the *inverse variance weight* w :

$$w_{Zr} = n - 3$$

Then the weighted mean effect size was calculated as:

$$\overline{ES} = \frac{\sum(w \times ES)}{\sum w}$$

Fisher's Z Transformation of r

While the correlation coefficient itself is an effect size statistic that can be interpreted for meta-analysis, the sampling distribution of the correlation coefficients, which is also called the standard error of the mean, is not normally distributed but skewed because the correlation is bound by +1 and -1. The skewed sampling distribution of the effect sizes can hardly be used for testing hypotheses that require a normal distribution and could be problematic in meta-analysis. More importantly, the standard error is used to determine the confidence intervals around the mean effect size, as well as to obtain the weight of the inverse variance for adjusting the bias due to the sample sizes.

To better address the normal distribution condition, the correlation coefficients were transformed to Fisher's Z_r coefficients. This Fisher's Z_r transformation can be done for the effect size from each individual study before averaging the effect sizes of eligible studies or for the averaged effect size of the product-moment correlation coefficient. The effect size formula of the Fisher's Z_r correlation, ES_{Z_r} , is as follows (Lipsey & Wilson, 2001, p. 64):

$$ES_{Z_r} = Z_r = .5 \log_e \left[\frac{1+r}{1-r} \right]$$

$$SE_{Z_r} = \frac{1}{\sqrt{n-3}}$$

$$w_{Z_r} = \frac{1}{SE_{Z_r}^2} = n - 3$$

Outlier Analysis

Extreme values may cause significant within-group heterogeneity of individual effect sizes that may not exist in reality (Lipsey & Wilson, 2001). Furthermore, the weighted averages given to large-sample-size studies may cause the overall effect size to be influenced by relatively few studies. Thus, extreme values of effect sizes were checked before computing the weighted means of effect sizes involved in each meta-analysis. Quartiles (called *fences*) were used to calculate the extreme values in the tails of each of the effect sizes distributions. If the lower quartile is Q1 and the upper quartile is Q3 (defined as the 25th and 75th percentiles), then the difference (Q3-Q1) is called the interquartile range or IQ. In this study, only the extreme values (i.e., the values outside of the upper and lower outer fences) were removed from the analyses while retaining the moderate extreme values (those within the inner fences) in the analysis. These values may occur simply due to large sampling errors, which have been previously corrected (Lipsey & Wilson, 2001). By applying this criterion, no original data points were deleted in the following analyses.

Calculating the Confidence Intervals Around the Mean Effect Size

Lipsey and Wilson (2001) stated, “Confidence intervals indicate the range within which the population mean is likely to be, given the observed data” and “this is useful in indicating the degree of precision of the estimate of the mean effect size” (p. 114). This study used the following formulae to calculate the standard error of the mean and the lower and upper limits:

$$se_{\overline{ES}} = \sqrt{\frac{1}{\sum w}}$$

If the confidence interval does not include zero, the mean effect size is statistically significant at $p \leq \alpha$. A direct test of the significance of the mean effect size will be obtained by computing a *z*-test as

$$Z = \frac{\overline{ES}}{se_{\overline{ES}}}$$

Test for Homogeneity

The effect sizes were tested for homogeneity. Homogeneity answers the question whether the effect sizes that are averaged in the mean are all from the same population (Lipsey & Wilson, 2001). The *chi-square* test was used for homogeneity. A *chi-square* test was used to determine if the study sample was homogeneous or heterogeneous. Homogeneous effect sizes would mean that the effect sizes all estimate the same population effect size (Lipsey & Wilson, 2001). The statistical significance of the heterogeneity of the mean effect size can be obtained from a chi-square statistic (χ^2) using the following formulas (Rosenthal & DiMatteo, 2001).

$$Q = \sum (w \times ES^2) - \frac{[\sum(w \times ES)]^2}{\sum w}$$

The statistic Q is tested against a chi-square distribution with $k-1$ degrees of freedom. If the test result is significant, the effect sizes in the distribution are assumed to be heterogeneous, which indicate that there is more variance across the effect sizes than expected due to sampling error alone. Therefore, combining individual effect sizes and interpreting the combined effect size estimates should be done with caution. There may be some distinctly different groups within the aggregated distribution of effect sizes, or extreme values in effect sizes exist.

Summary

This chapter explained the meta-analytic methodology used in this study. The design of the research method, as well as a restatement of the research questions was presented. The independent and dependent variables were defined. The research procedure, including the search for studies, the criteria for inclusion of studies, and the coding protocol were outlined. Lastly, method used to analyze the data from the studies was described. This included an explanation of

weighted effect size means, Fisher z transformation of r , outlier analysis, confidence intervals around mean effect size, and the test for homogeneity.

CHAPTER IV

RESULTS

This chapter presents the results of data analyses exploring the impact of text messaging on writing-related assessment outcomes. This study was guided by the following research questions:

1. What is the impact of students' use of text messaging on their academic writing, as shown on performance assessment outcomes?
2. Does the impact of students' use of text messaging on their academic writing as shown on performance assessment outcomes differ across educational levels (i.e., K-12 vs. undergraduate college)?
3. Does the impact of students' use of text messaging on their academic writing as shown on performance assessment outcomes differ across domains of writing (i.e., grammar vs. spelling)?

Meta-analysis of Text Messaging Impacts on Writing-related Outcomes

First, studies were identified for inclusion in the meta-analysis through the use of electronic databases. The studies were examined and coded for inclusion in the meta-analysis statistical procedures. The Pearson's correlation coefficient r , effect size, was either recorded from the selected studies or calculated using available data from the studies. For instance, where the t , F , Cohen's d , or Hedges' g statistics were given, formulas were available to calculate Pearson's r . The Comprehensive Meta-Analysis software (CMA) actually computes these values in the program, so there would be no need to make an isolated calculation. Instead, the data from

the studies was simply entered with the information that was available in the study, and then it can be converted to r ; however, these conversions were not necessary, as all effect sizes in the included studies were reported as Pearson's r .

The effect sizes for all the studies are included in the Table 4. An understanding of the results of the meta-analysis requires a general knowledge of the meaning of effect size measurements. The effect sizes that are used in the meta-analysis are included in one table, but include students from two separate school levels, K-12 and university undergraduate. The effect sizes ranged from a minimum of $-.42$ to a maximum of $.77$.

Table 4

Effect Sizes: All Included Studies

Researcher	Effect Size (r)	Writing Standard	School Level
Bushnell et al.	0.27	Spelling	K-12
Cingel & Sundar	0.34	Grammar	K-12
De Jonge & Kemp	-0.32	Spelling	K-12
Durkin et al.	0.77	Spelling	K-12
Kemp & Bushnell	0.21	Spelling	K-12
Kemp et al. ¹	0.45	Grammar	K-12
Kemp et al. ²	0.14	Grammar	K-12
Plester et al. ¹	0.35	Grammar	K-12
Plester et al. ²	0.52	Spelling	K-12
Plester et al.	0.70	Spelling	K-12
Varnhagen et al.	-0.42	Spelling	K-12
Wood et al.	0.04	Spelling	K-12
Drouin	0.71	Spelling	Undergraduate
Drouin & Davis	-0.16	Spelling	Undergraduate
Grace et al.	-0.10	Spelling	Undergraduate
Kemp	0.35	Spelling	Undergraduate
Kemp et al. ³	0.28	Grammar	Undergraduate

This sample of studies examined the effects of text messaging on five types of writing-related assessment measures. This led to the further examination of the effects of text messaging on the two standards of writing, grammar and spelling, most closely associated with the influence of text messaging. The effect of text messaging on all 17 of these outcomes permitted meta-analysis. The effect sizes in Table 4 were used to calculate the weighted mean effect size r for the meta-analysis.

Writing-related Assessment Measures

The 14 included studies used five writing-related assessment instruments to evaluate a total 1,652 students. The majority of the studies (45.6%) used the Wide Range Achievement Test to assess spelling proficiency. Spelling proficiency was also measured with the British Ability Scales (12.8%) and the Woodcock-Johnson Test of Achievement (7.7%). Grammar proficiency was measured with the Cognitive Abilities Test (18.4%) and the Test for Reception of Grammar (15.5%). Table 5 illustrates the details.

Table 5

The Distribution of Writing-related Assessment Instruments Used

Assessment Instruments	Writing Standard Assessed	No. Students	Percent
<i>British Ability Scales</i>	Spelling	228	12.8
<i>Cognitive Abilities Test</i>	Grammar	288	18.4
<i>Test for Reception of Grammar</i>	Grammar	243	15.5
<i>Woodcock Johnson Test of Achievement</i>	Spelling	186	7.7
<i>Wide Range Achievement Test</i>	Spelling	707	45.6
Total		1652	100.0

The majority of the studies (66.1%) used assessment measures that evaluated spelling proficiency, while 33.9% of the students were evaluated using assessments that measured grammar abilities. This distribution permitted the testing of moderating effects of writing

standard (grammar and spelling) in the later meta-analysis. Table 6 provides the details of this distribution.

Table 6

The Distribution of Writing Standards Assessed

Writing Standard Assessed	No. of Students	Percent
Grammar	531	33.9
Spelling	1121	66.1
Total	1652	100.0

The majority of the studies (72%) were conducted with K-12 students. College undergraduates were used as the sampling population in 28% of the studies. See Table 7 for details. This allowed for these moderating factors to be assessed later in the meta-analysis.

Table 7

The Distribution of School Levels

School Level	No. of Students	Percent
K-12	1188	72
Undergraduate	464	28
Total	1652	100

Effect Size Distribution

Table 8 shows the stem-and-leaf display and the summary statistics of the effect sizes r 's reported by the 14 studies. Cohen (1977) reported his general observation that over a wide range of studies in behavioral science research, the standardized mean difference of effects fell into the following ranges for correlation effect size values:

- $r \leq .10$ = Small
- $r = .30$ = Medium

- $r \geq .50 = \text{Large}$

Here, the median r value was .28 and the overall mean r value was .24, suggesting that the effect of text messaging on writing-related assessment outcomes was medium or moderate. The range of the middle 50% ($Q_3 - Q_1$) effect sizes was .45, indicating a comparatively moderate range of the values of effect size. The most common results fell into two ranges, with raw correlation effect sizes ranging from -.40 to -.10 and from .20 to .30. The latter group of effect sizes were much larger than the former.

Table 8

Stem-and-Leaf Display and Statistical Summary of Correlations Between Text Messaging use and Writing-related Assessment Outcomes

<u>Correlations (r's)</u>		<u>Summary Statistics</u>	
<i>Stem (width 0.1)</i>	<i>Leaf</i>	<i>(Based on r, not on z_r)</i>	
-0.	1234	Maximum	.77
0.	01	Quartile 3 (Q_3)	.45
0.	23333	Median (Q_2)	.28
0.	445	Quartile 1 (Q_1)	.04
0.	778	Minimum	-.42
		$Q_3 - Q_1$.41
		Mean	.24
		Standard Error	.06
		N	17.0
		Proportion positive sign	100.0%

Homogeneity Analysis

Homogeneity answers the question whether the effect sizes that are averaged in the mean are all from the same population. Table 9 shows the overall results of descriptive and homogeneity analysis of the effect sizes of text messaging effects on writing-related assessment

outcomes based on a mixed model. Seventeen correlation coefficients/effect sizes were involved in this analysis. The weighted mean r was .29, indicating that the effect of text messaging on writing assessment outcomes was moderate. The 95% confidence interval around the mean effect size ($.24 < \mu < .33$) did not include zero and indicated the effect was positive. The resulting Q value of 205.12 with 16 degrees of freedom was significant ($p = .00$). The variance in this sample of effect sizes was demonstrably greater than would be expected from sampling error alone. Thus, the hypothesis of homogeneity at $\alpha = .05$ was rejected.

Table 9

Descriptions of Effect Size Distribution Based on FEM & Homogeneity Analysis

Overall Effect	N of ES	Weighted Mean r	Standard Error for z_r	95% Confidence Interval		Q	df	P
				Lower end r	Upper End r			
Fixed Model	17	.29	.03	.24	.33	205.12*	16	.00

Heterogeneity Analysis

Since the Total Q was significant based on a fixed effects model, a random effects model was applied to see if there could be a random component that could explain the variability between studies. The resulting Q -value of 18.68 with 16 degrees of freedom was not significant ($p = .00$). This suggests that the variability in the population of effects plus sampling error sufficiently accounted for the excess variances of the sampled effect sizes. That being said, the random component (.33) was very large compared to the standard error (.09) in this case. This suggests that the differences between studies may have been the result of systematic errors. Systematic errors are irregularities that originate within the measuring instruments, and may occur because something is wrong with the instrument itself or because the instrument is used incorrectly. Further investigation is necessary to determine the significance of possible moderating factors.

Table 10

Descriptions of Effect Size Distribution Based on REM & Heterogeneity Analysis

Overall Effect	N of ES	Weighted Mean r	Standard Error for z_r	95% Confidence Interval		Q	df	P
				Lower end r	Upper End r			
Random Model	17	.28	.09	.11	.44	18.68	16	.00

Moderating Effects of School Levels and Constructs of Writing

Among the 14 studies (17 data sets), 12 were conducted in K-12 schools. The examination of the moderating effects of school level was not performed due to this very uneven distribution. Table 11 and Table 12 show the results of the variance analyses of the moderating effects of school level and leadership instrument based on FEM and MEM, respectively. Table 12 shows the details of the moderating effects and descriptives in subgroups, and Table 13 shows the summary of the weighted mean effect sizes in subgroups.

Table 11

Summary of One-Way Analog to the Analysis of Variance (Fixed Effects Model)

Moderator	Source of Variance	Q	df	P
School Level K-12 vs. Undergraduate	Between Groups	1.26*	1	.26
	Within Groups	203.86*	15	.00
	Total	205.12*	16	.00
Writing Standard Grammar vs. Spelling	Between Groups	1.33*	1	.25
	Within Groups	203.78*	15	.00
	Total	205.12*	16	.00

*Significant at $\alpha = .05$

Table 12

The Moderating Effect of School Level and Writing Standard on the Relationship Between Text Messaging use and Writing-related Assessment Outcomes on Mixed Effects Models

Moderator	Source of Variance	Q	df	P
School Level K-12 vs. Undergraduate	Between Groups	.02	1	.90
	Within Groups	17.30	15	.13
	Total	17.32	16	.00
Writing Standard Grammar vs. Spelling	Between Groups	.07	1	.79
	Within Groups	17.10	15	.08
	Total	17.17	16	.00

*Significant at $\alpha = .05$

Table 13

A Summary of Weighted Mean Effect Sizes of Text Messaging Impacts on Writing-related Assessment Outcomes and Homogeneity Analyses in Subgroups Based on Mixed Effects Models

	N of ES	Weighted Mean r	Standard Error for z_r	95% Confidence Interval		Q_w	df for Q	P for Q
				Lower end r	Upper End r			
School Level								
K12	12	.29	.01	.10	.46	15.57	11	.00
Undergraduate	5	.26	.05	-.17	.60	2.92	4	.24
Writing Standard								
Grammar	5	.32	.05	.23	.41	4.09	4	.00
Spelling	12	.26	.13	.01	.49	12.45	11	.04

Note. $p < .05$

The mean effects of text messaging on writing-related assessment outcomes did not differ significantly between K-12 and undergraduate students ($Q_B = 1.26$; $p = .26$). The Q_w was significant ($Q_w = 203.86$; $p = .00$). This indicated that factors may exist that moderate the impact of the use of text messaging on students' writing skills within the studies that were conducted in K-12 school settings.

The homogeneity analysis of the effect sizes of text messaging's effects on writing-related assessment outcomes based on a mixed model included 17 correlation coefficients/effect sizes. The weighted mean r was .29, indicating that the effect of text messaging on writing

assessment outcomes is moderate. Thus, the hypothesis of homogeneity at $\alpha = .05$ was rejected. Since the total Q was significant based on a fixed effects model, a random effects model was applied to see if there could be a random component that could explain the variability between studies. The resulting Q -value of 18.68 with 16 degrees of freedom was not significant ($p = .00$). This suggested that the variability in the population of effects plus sampling error sufficiently accounted for the excess variances of the sampled effect sizes. In summary, the effect of text messaging on writing-related assessment outcomes between school levels was not significant.

The mean effects of text messaging on writing-related assessment outcomes did not differ significantly when different writing standards were evaluated ($Q_B = 1.33$; $p = .25$). This suggests a random component may exist in the error, as well. This indicated that factors may exist that moderate the impact of the use of text messaging on students' writing skills within the studies that assessed grammar and spelling.

The homogeneity analysis of the effect sizes of text messaging's effects on writing-related assessment outcomes based on a mixed model included 17 correlation coefficients/effect sizes. The weighted mean r was .32, indicating that the effect of text messaging on writing assessment outcomes is moderate. Thus, the hypothesis of homogeneity at $\alpha = .05$ was rejected. Since the total Q was significant based on a fixed effects model, a random effects model was applied to see if there could be a random component that could explain the variability between studies. The resulting Q -value of 17.17 with 16 degrees of freedom was not significant ($p = .00$). This suggested that the variability in the population of effects plus sampling error sufficiently accounted for the excess variances of the sampled effect sizes. In summary, the effect of text messaging on writing-related assessment outcomes between grammar and spelling proficiency outcomes was not significant.

Summary

A meta-analysis of the influence of text messaging on writing-related assessment outcomes showed that effect sizes for all included studies ranged from a minimum of $-.42$ to a maximum of $.77$. The analysis of writing-related assessment measures included 14 studies using five writing-related assessment instruments, and 1,652 students were evaluated. The majority of the studies (66.1%) assessed spelling and used the Wide Range Achievement Test, the British Ability Scales, or the Woodcock-Johnson Test of Achievement. Grammar proficiency was assessed in 33.9% of the studies, and the Cognitive Abilities Test and the Test for Reception of Grammar were the instruments used. The majority of the studies (72%) were conducted with K-12 students, and college undergraduates were used as the sampling population in 28% of the studies.

The analysis showed a significant positive correlation between text messaging and writing-related assessments ($r = .28$), suggesting that as text messaging use increases, writing-related assessment outcomes also increase. While text messaging's impact on writing-related assessment outcomes was significant, the mean effects of text messaging on writing-related assessment outcomes did not differ significantly when different writing measures (grammar and spelling; $Q_B = 1.33$; $p = .25$) or different school levels (K-12 and college undergraduate) were evaluated ($Q_B = 1.26$; $p = .26$). This suggests that neither writing standard nor school level has a moderating effect on the impact of text messaging on writing-related assessment outcomes.

CHAPTER V

DISCUSSION AND RECOMMENDATIONS

The introduction of mobile phones and texting has greatly impacted the way in which people communicate (Kemp & Bushnell, 2011), and written text message communication is quickly replacing oral phone communication for many teens (Lindley, 2008). Even though research has shown that students today spend more time writing than students of any previous generation (Baron, 2011; Bauerlein, 2008, 2010), results of the most recent NAEP Writing Test indicated that approximately two-thirds of the nation's 8th and 12th grade students performed at a basic level writing proficiency, meaning that these students had only partial mastery of the knowledge and skills that are fundamental for proficient writing at these grade levels (Bauman & Davis, 2013).

The increase of text messaging's popularity at a time when national writing test scores showed dismal results has led many to believe that text messaging use is negatively affecting students' abilities to write in formal, Standard English. Coe and Oakhill (2011) claimed that the media purports massive speculation and concern regarding the harmful effects of text messaging on literacy abilities, and Plester et al. (2008) stated that this connection between texting and academic writing, "is based on anecdotes and reported incidents of text language used in schoolwork" (p. 138). Rosen, Chang, Erwin, Carrier, and Cheever (2010) added that "educators and the media have decried the use of these shortcuts, suggesting that they are causing youth . . . to lose the ability to write acceptable English prose" (p. 421), and Vosloo (2009) agreed that "for

a number of years teachers and parents have blamed texting for two ills: the corruption of language and the degradation in spelling of youth writing” (p. 2).

Contrary to presumptions such as these, after an exhaustive search for all relevant studies, this meta-analysis showed that text messaging actually had a positive and significant impact on writing-related assessment outcomes. This chapter provides a discussion and interpretation of the findings of the present study, as well as the findings relative to previous studies that examined the relationship between text messaging and student writing assessment outcomes. This is followed by a discussion of the limitations. The chapter concludes with a discussion of the implications for future research and educational practice, including a presentation of suggestions for additional study relative to text messaging and student writing measures.

Summary of Findings

The purpose of this study was to conduct a meta-analysis on the impact that text messaging has on students’ writing skills. To achieve the objectives of identifying the impact of the effect of text messaging on students’ writing-related assessment outcomes, three research questions were examined. The questions and their findings are provided below.

Research Question 1. What is the impact of students’ use of text messaging on their academic writing, as shown on performance assessment outcomes?

This study provided a meta-analysis of the impact of text messaging on writing-related assessment outcomes. The dependent variables were unknown at the beginning of this study because I did not know the extent of the previous research that focused exclusively on writing-related assessment measures. I also did not know which writing constructs, or domains of writing evaluation, were vulnerable to the influence of text messaging. Lastly, I did not know if I would find research that used standardized instruments to measure writing-related assessment outcomes. After a review of literature, I determined that although the research between text

messaging and student writing was growing, most of the existing literacy-focused research focused on the relationship between text messaging and measures of reading.

Fourteen studies, including 17 sets of data, assessing the relationship between text messaging use and writing-related assessment measures were located. Together, these studies used five different standardized assessments to measure two areas of knowledge related to writing evaluation. The five instruments included the British Ability Scales, Woodcock-Johnson Test of Achievement, and Wide Range Achievement Test (used to assess spelling proficiency), and the Cognitive Abilities Test and Test for Reception of Grammar (used to assess grammar proficiency).

The 17 sets of data represented assessment measures from 1,652 students. The average effect size between text messaging and assessment outcomes related to writing standards was .28, and the overall mean r value was .24, suggesting that the effect of text messaging on writing-related assessment outcomes is medium or moderate. The range of the middle 50% ($Q3 - Q1$) effect sizes was .45, indicating a comparatively moderate range of the values of effect size. The most common results fell into two ranges, with raw correlation effect sizes ranging from -.40 to -.10 and from .20 to .30. The latter group's effect sizes (Bushnell et al., 2011; Cingel & Sundar, 2012; Durkin et al., 2011; Drouin, 2011; Kemp, 2010; Kemp & Bushnell, 2011; Kemp et al.,³ 2014; Plester et al.,^{1,2} 2008, 2009) were much larger than the former (De Jonge & Kemp, 2012; Drouin & Davis, 2009; Grace et al., 2014). An average effect size of .28 indicates a moderate positive influence of text messaging on writing-related assessment outcomes. This means that as text messaging use increased among students, so did their writing-related assessment outcomes. This finding supports those presented in the review of literature (Bushnell

et al., 2011; Cingel & Sundar, 2012; Drouin, 2011; Durkin et al., 2011; Kemp, 2010, Kemp & Bushnell, 2011; Kemp et al., 2014; Plester et al., 2008, 2009).

Additionally, this result supports the dialectical constructivist model, as the source of academic writing knowledge occurs in the formal, in-school environment of the classroom, yet for many students, the act of writing happens during the social interaction of text messaging, which is an informal, out-of-school activity (Crystal, 2008). The positive and significant finding for the first research question provides further confirmation of this paradigm.

Research Question 2. Does the impact of students' use of text messaging on their academic writing as shown on performance assessment outcomes differ across educational levels (i.e., K-12 vs. undergraduate)?

Answer. The mean effects of text messaging on writing-related assessment outcomes did not differ significantly between K-12 and undergraduate students ($Q_B = 1.26; p = .26$). This indicates that school level was not shown to be an effective moderating factor when analyzing text messaging's influence on writing-related assessment outcomes. Overall, writing assessment outcomes did not vary based on school level, meaning that text messaging had a positive and significant impact on student writing skills in both K-12 and college undergraduate students. Text messaging did not impact student writing skills in K-12 any more or less than students in college. This research applied to other similar studies by building upon the studies of Plester et al. (2009) that showed a positive correlation between text message volume and student competence with literacy and language. In addition, this finding supported the research of Kemp et al. (2014) and Plester et al. (2008) who looked at correlations between school levels. It is also possible that that as text messaging becomes more popular, that "college students with greater reading and spelling abilities may be using text messaging more frequently, or that those with poorer literacy skills may be using text messaging less frequently" (Drouin, 2011, p. 72). Many

avenues of potential research and specific variable correlations are open, as the research in this field has only just begun.

Research Question 3. Does the impact of students' use of text messaging on their academic writing as shown on performance assessment outcomes differ across domains of writing (i.e., grammar vs. spelling)?

Answer. The mean effects of text messaging on writing-related assessment outcomes did not differ significantly between writing standards ($Q_B = 1.33$; $p = .25$). This indicates that the standard of writing evaluation, grammar or spelling, was not shown to be an effective moderating factor when analyzing text messaging's influence on overall writing-related assessment outcomes. Overall, writing assessment outcomes did not vary based specific writing measure. This finding supported the research of Kemp et al. (2014), who looked at the correlations between grammar and spelling.

Limitations

The limitations of meta-analysis were explained in Chapter I. These included “comparing apples to oranges,” “garbage in garbage out,” “the file drawer problem,” and “publication bias;” however, additional limitations to this research apply. Another limitation of this study was that separate data analyses from individual studies (i.e., Kemp et al., 2014 and Plester et al., 2008) were included and may have added more variances in the distribution of study results; however, according to Lipsey and Wilson (2001), this is a valid manner in which to treat the studies in a meta-analysis. This could be one factor that could explain the heterogeneity of variances in within groups. Another limitation of this study was its focus on quantitative evidence only.

Lastly, although this study used the term “impacts” throughout the text, the claims this study makes regarding the relationship between text messaging and students' writing-related assessment outcomes are correlational in nature. This is because all of the statistical analyses

used by the original studies included in this review were correlational in nature, and it was upon their reported effect sizes (Pearson's correlation coefficient r) that this meta-analytical review was based. Even using inferential analyses, strong causal inferences were not actually permissible because different research procedures were used in the sample studies; that is, different sampling methods (random or non-random), settings (K-12 and undergraduate), student outcome measures (grammar and spelling assessment outcomes), and other research design components (Cooper & Hedges, 1994). This study only provides a correlation of variables, and causation cannot be inferred from these results.

Implications for Future Research

This meta-analysis is one of a small handful of studies just beginning to examine text messaging use and its impact on the writing proficiencies of students. The results showed a positive and significant influence of text messaging on writing-related assessment outcomes, yet the school level of the students and the area of writing being assessed did not significantly impact this relationship. Although there are some things we know about text messaging and its effect on writing-related assessment outcomes, there is still much we do not know. In addition to the gap that exists in the literature regarding text messaging and actual writing assessments, such as the NAEP, PSAT, or SAT, there are other areas available for future contributions. Some of these include the following:

- Text messaging is fairly new; therefore, longitudinal studies on correlations between text messaging and grammatical skills and spelling are needed for further understanding.
- As text messaging gains common use in both informal and formal situations, research on code switching and register change among different recipients would be of value.

- Exploration of how textisms evolve within text messaging communications and how nonstandard words develop into Standard English.
- Comparisons between text messaging and other forms of English dialects and their impact on the formal English register.

Since this study only sought to find a relationship between its variables, continued studies could be conducted to determine how one variable (text messaging) actually leads to the other variable (writing-related skills) and why. Some closely-related future studies on this subject could include comparing students' average monthly text message volume and use to other validated writing tests, such as the ACT (American College Test) COMPASS (Computerized Adaptive Placement Assessment & Support System) exam.

Implications for Educational Practice

The results of this study provide practitioners with a heuristic to guide their thinking and practice about texting as an instructional tool in schools. It does this by confirming a significant link between text messaging and writing-related assessment measures. The positive and significant relationship between texting and writing skills supports a dialectical constructivist model of instruction and learning (Moshman, 1982) because as students' use of the out-of-school activity of text messaging increases, in-school, writing-related assessment outcomes also increase. That is, the social interaction of text messaging is more than simply a means to facilitate and transfer information to one another; the dialectical paradigm, as supported by the findings of this meta-analysis, shows that social interaction may be a part of the foundation of the learning process (Moshman, 1982).

In the process of sending and receiving text messages, learners may reconfigure and refine their individual writing-related knowledge because of the collaborative effects of the

interactive experience. An instructional guideline for practitioners would include recognizing students' predisposition toward learning and structuring content sequence and delivery in a way that best meets the students' background knowledge. Teachers will contribute to knowledge construction by activating students' prior knowledge and personal experiences of text messaging and aligning that knowledge with standards of writing assessment.

Text messaging has great potential as an educational tool. Findings show that texting and text abbreviations have a moderately positive impact on the skills needed for academic writing, though this is focused only on the areas of grammar and spelling. These findings are encouraging and suggest that teachers could incorporate discussions and exercises around text messaging use into their lessons as a fun, engaging, and comfortable means of exposing students to new grammar rules and spelling conventions. This might include the following:

- Discussing the difference between standard and non-standard English use in both writing and speaking. Many activities could be structured around the differences and importance of proper use in place and time of each.
- Showing students how many different ways a word written in Standard English can be spelled in textese.
- Practicing spelling words and grammar constructs through “translating” text messages.

In the upcoming winter and spring months of 2016-17, students in grades four and eight across the country will be administered the 2017 NAEP Writing Test. High school students, no longer having to adhere to the stringent NCLB (2002) regulations, will not be taking the NAEP; however, many will still be devoting at least one Saturday morning to taking a nationally recognized college entrance or placement exam, and rest assured, they will be writing. The

results of these tests will eventually be displayed, and student writing proficiencies will be scrutinized. The variables connected to the process of writing and writing evaluation are many, and measuring text message use and engagement is tedious and time consuming. Perhaps this study, if it does nothing else, will illuminate the fact that even the most seemingly simple questions are often more complex than they appear.

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APPENDIX A
IRB EXCLUSION LETTER

February 29, 2016

Amy Everett
Dept. of Curriculum & Instruction
College of Education
Box 870232

Re: PhD Student Curriculum & Instruction Project

Dear Ms. Everett:

This letter comes as a response to your communication received on 2/24/16. According to the Office for Human Research Protection (OHRP) under policy 45 CFR 46.101 the proposed work is not human subjects research.

Because the work is not considered human subjects research, it does not require IRB approval and is therefore excluded from review by the IRB.

If you have any questions or if I can be of further assistance please do not hesitate to contact me.

Sincerely,



Director & Research Compliance Officer

APPENDIX B
CODING MANUAL

A separate coding is used for each writing standard that is evaluated. This will allow the data to be easily utilized in the calculation of the meta-analysis.

1. **APA Citation.** Write the citation (or copy and paste from EndNote) in accordance with the American Psychological Association guidelines.
2. **Study ID (Identification).** The study ID should consist of the letter A or B followed by a “–” and then the next unused number in the sequence counting from 1 until all studies have been coded.
 - a. The letter represents the following school level of the participants from the study.
A = K-12 or B = Undergraduate
 - b. The number represents the next number in the sequence counting from “1.”
3. **Year Study Published.** Record the year the study was published in the publication.
4. **Publication Type.** Record one of the following for publication type.
 - a. Journal = 1
 - b. Federal or Association Study = 2
 - c. Dissertation = 3
 - d. Other = 4
5. **Sampling Method.** Describe the method used to sample or assign students for the study.
6. **Mean Age.** Mean age of students in population.
7. **School Level (American Equivalent).** Record one of the following for grade level:
 - a. K-12 (5–18 years old) = 1
 - b. University Undergraduate (any age) = 2
8. **Assessment Instrument.** Record one or more of the following for instrument:
 - a. BAS
 - b. CAT
 - c. WJ
 - d. TROG
 - e. WRAT
 - f. Other
9. **Writing Standard.** Record the writing standard that was evaluated as coded below:
 - a. Grammar = 1
 - b. Spelling = 2

The next section includes the statistical information that should be recorded as is available in the study. All of the information may or may not be available in the study.

10. **N (the sample size in the study).**

11. **t–statistic.**
12. **F–statistic.**
13. **Standard Deviation.**
14. **Effect Size** (Cohen's *d* or Hedges' *g*)
15. **Correlation Coefficient *r*.**

APPENDIX C
CODING FORM

APA Citation	
Study ID	
Year Study Published	
Name of Publication	
Publication Type	
Sampling Method	
Mean Age	
School Level K-12 = 1 / Undergraduate = 2	
Assessment Instrument	
Writing Standard Grammar = 1 / Spelling = 2	
N	
t-statistic	
F-statistic	
Standard Deviation	
Effect Size (Cohen's <i>d</i> or Hedges's <i>g</i>)	
Correlation coefficient (<i>r</i>)	