

**WRITING TASKS IN CONTENT-AREA INSTRUCTION:  
A SYSTEMATIC REVIEW OF THE LITERATURE**

A Dissertation

by

DIANE MORRIS MILLER

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Chair of Committee,	Erin M. McTigue
Committee Members,	Trina J. Davis
	R. Malatesha Joshi
	Jeffrey Liew
Head of Department,	Yeping Li

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## **ABSTRACT**

Situated within the historical and current state of writing and adolescent literacy research, this systematic literature review screened 2,871 articles to determine the prevalent themes in current research on writing tasks in content-area classrooms. Each article in the final corpus of 37 studies was evaluated and coded using seven methodological quality indicators. The qualitative synthesis of studies is organized by the categories of context, cognition, and content, and the studies are grouped within each category by relevant themes in order to explore how the incorporation of writing tasks into content-area instruction benefits secondary students' content-area learning and knowledge acquisition. Findings address themes such as the aspects of explicit-strategy and inquiry-based instruction, the impact of prewriting models, the role of metacognition and journaling, and the writing-related implications for content-area assessment. Suggestions of strategies for secondary content-area teachers to use in the integration of writing tasks into their instruction and future directions for research are offered.

## DEDICATION

To my parents, Dr. David and Nancy Morris, for raising me to pursue excellence in everything and to finish what I start.

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## CHAPTER I

### INTRODUCTION

Literacy is not to be confused with literature, although it often is. When the two are thought of synonymously, especially in the discipline-driven, discipline-delineated secondary school environment, then the isolated responsibility of teaching literacy skills is doled out to the English language arts teachers. In fact, according to Siebert and Draper (2008), a widely held belief of content-area teachers is that it is “someone else’s responsibility” (p. 229) to teach the literacy skills of reading and writing. Ironically, English language arts teachers grapple with their own body of content knowledge, characterized by jargon and facts just like any other discipline. Rather than propagating a climate of blame, literacy should be redefined in our school cultures, such that it is an inherent skill set across all disciplines and contents (Vacca, 2002).

Once the content-area knowledge becomes more advanced, however, the basic multi-disciplinary literacy skills no longer suffice. There is an undeniable responsibility and allegiance to the integrity of the disciplines that deserves preservation and consideration. On the secondary level, content expertise gains an intensified focus—and rightly so. Specialization deepens expertise; not many teachers claim to be Renaissance men and women who master multiple disciplines. Scientists teach science, mathematicians teach math, and historians and economists teach social studies (Shanahan & Shanahan, 2008).

Despite this more intimate focus upon the distinct disciplines, the concept of teaching the whole student supports the core learning that must take place. Within that concept lies a universal responsibility for transferable skill sets as well as discipline-specific tools that can serve students well, no matter which discipline woos them more successfully. The literacy of reading and writing forms that learning core.

Educational researchers have sought to clarify efforts to improve the literacy of secondary students. In *Reading Next: A Vision for Action and Research in Middle and High School Literacy*, Biancarosa and Snow (2006) outline fifteen elements that ideally should be present in adolescent literacy programs. Two of these elements pertain directly to the purpose of this study: (a) “Effective instructional principles embedded in content, including language arts teachers using content-area texts and content-area teachers providing instruction and practice in reading and writing skills specific to their subject areas,” and (b) “Intensive writing, including instruction connected to the kinds of writing tasks students will have to perform well in high school and beyond” (p. 4). The authors envision a school in which students are taught and encouraged to use reading and writing skills to become “subject-area experts” (p. 15) in each of their courses.

Shanahan and Shanahan (2008) encourage this discipline-specific model of literacy advancement. The authors emphasize the development of literacy skills that are particular to the increasing demands of separate content areas. For students to succeed in an evolving economy and society, they must meet the demands of higher levels of literacy, unlike prior generations.

In a similar vein, practitioners agree with the direction of the research, and thus many school districts have adopted a vision for content-area literacy. For example, the Southern Regional Education Board's list of the ten best practices for middle school success includes this fourth component: "Focus on improving students' reading and writing skills by giving reading and writing assignments that engage students in reading grade-level materials specific to each content area—English, math, science and social studies" (Bottoms & Timberlake, 2012, p. 5).

The visions described above, combined with additional reviews by Graham and Perin (2007a, 2007b, 2007c) and a prior review by Bangert-Drowns, Hurley, and Wilkinson (2004), provided the impetus for the current systematic literature review of studies addressing writing tasks in secondary content-area classrooms. While the conceptual need to incorporate reading and writing into content-area classrooms has been repeatedly addressed in the research, the details of how to operationalize this thinking are not always readily available. A systematic review of the most current studies in the area of content-area writing would help to identify and categorize practical strategies for implementing writing tasks in the secondary content-area classroom.

Four chapters follow this introductory chapter. Chapter II contains a three-section literature review. The goal is to provide an explicit context and rationale for the current study. The first section provides a brief synopsis of the evolution of writing instruction and how it is often eclipsed by a more stringent focus upon reading, thus creating a case for a review to focus solely upon writing. Next, the second section serves as a brief summary of the current research in the areas of writing development,

instruction, and assessment, thus crafting an overview of students' writing existence in educational settings. Finally, a third section more specifically positions the current study within a description of writing tasks in the content-area classrooms, a discussion of the relevant published reviews, and an explanation of the key terms applicable to the study. Chapter III defines the current study through an explicit description of the methodology employed by the researcher. After a discussion of the purpose of the current study and a list of the research questions, the components of the systematic literature review (searching, screening, and coding) are explained. Chapter IV presents the findings of the systematic literature review. The results of each step of the searching, screening, and coding processes are revealed, and the coding process discussion is enhanced with the details of interrater reliability. The second section in this chapter contains the descriptive statistics for the final corpus of articles followed by the synthesis of the articles in terms of categories and themes. Finally, Chapter V interprets the entirety of the systematic literature review and the resulting findings. This chapter also addresses the limitations of the current study along with directions for future research and conclusions.

## CHAPTER II

### LITERATURE REVIEW

#### **A History Lesson: Reading Trumps Writing?**

Historically in the educational research, the answer to the above question seems to be an affirmative one: reading does trump writing. The second edition of the *Handbook of Research on Teaching the English Language Arts* opens with an applicable history lesson. Squire (2003) tells the story of a relatively new discipline, one that was not even recognized as a major until 1896 at Oxford University. Since English language arts and reading (known in many settings as “ELAR”) is a discipline that encompasses diverse components—reading skills, literature study, writing, speaking, and listening—the profession’s focus has seen major shifts and controversies over where the emphasis should lie.

According to Squire (2003), the push of standardized testing in the 1940s, 50s, and 60s prompted a focus on basic skills. After splintering off from the National Council of Teachers of English (NCTE) amidst frequent debates over skills-based versus experience-oriented instruction, reading teachers formed the International Reading Association (IRA) in 1955 (Squire, 2003). However, considering the history of writing education would be incomplete without considering the politics and policies that influenced it. Accordingly, Ruth (2003) posits that publications such as *Why Johnny Can’t Read* (a book by Rudolf Flesch published in 1955) and *A Nation at Risk: The Imperative for Educational Reform* (a report of the National Commission on Excellence

in Education published in 1983) set the stage for a focus on reading that eclipsed, in the world of government funding, the burgeoning field of composition studies. The composition theory and research that blossomed in the 1970s had not reached the level of urgency that reading researchers and theorists had been able to foster.

A fairly recent emphasis on writing research was spurred by the College Board's plan to include a writing sample with its college entrance exam, the SAT (formerly the Scholastic Aptitude Test), beginning in 2005 (Shaw & Kobrin, 2012). In 2003, The National Commission on Writing in America's Schools and Colleges published a call to action for policymakers and educators, *The Neglected "R": The Need for a Writing Revolution*. The report used the National Assessment of Educational Progress (NAEP) test data and the impending change in SAT testing to raise awareness and argue that writing instruction should receive the same intensity of focus enjoyed by reading and mathematics.

Biancarosa and Snow (2006) then narrowed the focus to literacy in the adolescent years with the publication of *Reading Next: A Vision for Action and Research in Middle and High School Literacy*. As noted in Chapter I of the current study, these authors included writing as a crucial component in their list of fifteen elements. Graham and Perin (2007c) followed the writing research meta-analysis methods of individuals such as Hillocks (1987) in their answer, *Writing Next: Effective Strategies to Improve Writing of Adolescents in Middle and High Schools*. In their additional work, Graham and Perin (2007a, 2007b) found 582 potential studies in the initial search for their 2007 meta-analysis on writing. That number of studies did not come close to approaching the



numbers reported by the National Institute of Child Health and Human Development (NICHD, 2000) for reading research studies, which was estimated to be more than 100,000. The following year, Graham (2008) wrote the introduction to an issue of *Reading and Writing*, noting that even with such an inclusionary and equitable title, a special issue had to be set apart and devoted to the topic of writing. Perhaps educational research has propagated the notion of the “neglected ‘R’” (National Commission on Writing in America’s Schools and Colleges, 2003; see also Goatley, 2012).

### **Current Writing Research on Students’ Writing Existences in Schools**

Transitioning from the history of writing research to the current status of the field of writing is essential to contextualizing this systematic review. The general areas of writing development, instruction, and assessment will be addressed to describe the major facets of students’ writing existence in educational settings. A synopsis of the stages of writing development is complemented by an overview of instructional practices. A brief discussion of writing assessment follows, including both formative and summative evaluations of writing progress and performance. In the next section, more specific attention is focused upon writing tasks in content-area instruction, related reviews in the field, and key terms for the current study.

### **Writing Development**

In this section, writing development is presented through both the similarities and the differences to reading development. First, the parallels between writing and reading developmental processes are described. This description serves to frame a discussion of

the differences between writing and reading processes. Finally, the idea that the writing-to-learn research can help to bridge the gaps between the two processes is explored.

**Writing and reading developmental processes.** Often, researchers describe the writing developmental processes in terms of how they mirror the reading developmental processes. With the publication of *Because Writing Matters: Improving Student Writing in Our Schools* (National Writing Project [NWP] & Nagin, 2003), the NWP contributed to the effort to bring more attention to the field of writing. Although the book's overview is somewhat broad, the text does offer interesting insights into the development of writing skills as they relate to reading skills, such as an interview with P. David Pearson on how reading and writing develop in young children. Pearson describes the relationship between reading and writing as “synergistic” (NWP & Nagin, 2003, p. 33) and notes symmetric relationships in the following key areas of development: (a) phonemic awareness—children are encouraged “to spell words as they sound them” (p. 33), (b) letter-sound knowledge—“phonics is so much more transparent in spelling than it is in reading” (p. 33), (c) structural and conceptual modeling—“writing makes things concrete and puts it out there for inspection” (p. 34), (d) speed of language examination—“when I write, that examination is made even more concrete than when I read” (p. 34), (e) strategies—with peer editing and author's chair, students are “engaging in the first steps of critical reading” (p. 34), and (f) texts—“what we write is written to be read” (p. 35).

Conceived within a slightly different interpretation from Pearson's, Elbow (2004) issues a passionate call for writing instruction alongside—or even before—

beginning reading instruction. He maintains that writing can bring a more mentally and physically active state to reading tasks, “breaking out” of traditional reading tasks that are associated with passive “consumption” (p. 10) and consciously crafting situations that engage students as active readers and active writers.

**Differences between reading and writing.** Others agree that this idea of synergy does not mean that reading and writing are the same processes. Research by Berninger, Abbott, Abbott, Graham, and Richards (2002) examines the way language is processed through the four systems of the mind: “language by ear (aural), language by mouth (oral), language by eye (reading), and language by hand (writing)” (p. 39). Although some reciprocity exists, it should not be assumed that reading and writing are simply inverse processes.

Berninger and colleagues (2002) found that reading enhances composition quality at all grades but that writing only impacts comprehension beginning around 4<sup>th</sup> grade. In their discussion, the authors posit that the normal sequence of writing development requires that the introduction of writing tasks into content-area instruction should not occur until after the writing/comprehension connection is realized more fully.

The Common Core Standards recognize this reality, as evidenced by the structure of the English language arts standards (National Governors Association Center for Best Practices [NGA Center] & Council of Chief State School Officers [CCSSO], 2010). Even though the first set of skills is categorized into grades and/or grade bands for K-12 English language arts classes, a second set of standards is delineated for grades 6-12 literacy standards in history/social studies, science and technical subjects, and general

content-area writing tasks such as writing to persuade, inform, explain, and present research.

After these beginning stages of development, students do not automatically become proficient writers in the sixth grade. According to Graham and Perin (2007c), “Writing proficiency develops over time” (p. 23). First, writers must develop fluency of ideas. Second, an awareness of form comes through an attention to audience and craft. Finally, correctness plays a role in the clear communication of ideas.

**Writing to learn.** These tenets of writing development dovetail with the cognitive theories of writing that guide writing-to-learn research. Britton (1970) and Emig (1977) began advocating that writing processes were similar to learning processes; however, the past four decades of writing-to-learn research have clarified their more holistic stance into both metacognitive and process stances. Graham, Gillespie, and McKeown (2013; see also Bangert-Drowns et al., 2004; Gunel, Hand, & McDermott, 2009; Keselman, Kaufman, Kramer, & Patel, 2007) frame these stances within two major conceptual approaches. One approach examines writing through the writer’s cognition and motivation, while the other approach emphasizes the context in which the writing originates and evolves. Bereiter and Scardamalia (1987) proposed the metacognitive stance, wherein writers move gradually along the continuum from *conveying* knowledge, a more novice-oriented activity, to *transforming* knowledge, a more advanced-oriented activity. Conversely, Torrance and Galbraith (1999) proposed a process stance in which students are *constituting* and *generating* knowledge during the stages of the writing process.

## **Writing Instruction**

In light of what is known about writing development, researchers have worked to integrate writing instruction as it becomes relevant in the developmental stages. Several approaches and strategies are discussed in the current research on writing instruction. Even though some of these approaches and strategies may be uniquely named or described by other authors, the components of writing instruction that are discussed in the following paragraphs align well with the writing development stance advocated by the meta-analytic work of Graham and Perin (2007c).

**Approaches to teaching writing.** In *Teaching Writing in the Middle and Secondary Schools: Theory, Research, and Practice*, Soven (1999) defines four approaches to teaching writing: correctness, personal growth, rhetorical, and sociocultural. Glasswell and Kamberelis (2007) used this same framework of approaches when reviewing the *Handbook of Writing Research*. Their analysis of the chapters in the handbook concerned them since the current cognitive stance of the theorists and researchers does not seem to be reflected in classrooms.

**Explicit instruction.** Explicit and systematic strategy instruction, the first item on the list from *Writing Next* (Graham & Perin, 2007c), has been the focus of much research (Graham, Harris, & MacArthur, 2006; MacArthur & Lembo, 2009; Tracy, Reid, & Graham, 2009). One well-researched process that includes explicit strategy instruction is Self-Regulated Strategy Development (SRSD). In this instructional model, the teacher explicitly teaches and models the writing emphasis for the day, thus clarifying a process that can seem covert or hidden for students. Students are

encouraged to gather materials and background knowledge to increase engagement and pre-writing effectiveness, and then they write step-by-step according to the SRSD method. According to Graham and Perin (2007c), the model contains six distinct steps: (1) the teacher helps students to develop background knowledge; (2) the teacher describes the strategy; (3) the teacher models the strategy; (4) the student memorizes the strategy and mnemonic, if applicable; (5) the teacher supports and scaffolds for student mastery; and (6) the student independently applies the strategy. Also, students are introduced to self-regulation and goal-setting skills throughout the process. SRSD is purported to be a flexible instructional model that guides the explicit introduction of writing strategies and has been shown to mesh well with approaches such as writing workshop (Harris & Graham, 1999).

Explicit instruction has also been found to be effective with struggling, at-risk, and dyslexic students (Berninger, Nielsen, Abbott, Wijsman, & Raskind, 2008; Berninger, Vaughan, et al., 2002; Berninger, Winn, et al., 2008). Two studies warn that dyslexia is not merely a reading disability and that difficulties with spelling and transcription necessitate engaging writing interventions for dyslexic students as well (Berninger, Nielsen, et al., 2008; Berninger, Winn, et al., 2008). The construction of words during the writing process provides an invaluable venue for teaching explicit sound-symbol correspondence. In fact, Berninger, Nielsen, and colleagues (2008) purport that the benefits of explicit writing instruction outweigh the more pervasive practice of implementing writing accommodations once a student is dismissed from dyslexia services. Berninger, Vaughan, et al. (2002) also found that struggling students

benefitted from a combined approach of explicit instruction in both spelling and compositional strategy.

**Collaborative writing.** Both the strategy of collaborative writing and the writing process instructional approach are addressed in recent studies (Cho & MacArthur, 2010; Midgette, Haria, & MacArthur, 2008). Student writing is more likely to improve with the feedback from multiple peers rather than a single peer or a single expert (Cho & MacArthur, 2010). In another study, Midgette and colleagues (2008) found that writing products were enhanced when the peer revision sessions were centered on the goal of content and audience awareness. However, recent student report data from the NAEP results show that collaborative writing strategies are not used as frequently as recommended by research. Students reported using collaborative strategies, such as brainstorming with a peer, only 15% of the time and working with others in pairs or small groups approximately 25% of the time (Applebee & Langer, 2009).

In their introduction to a recent issue of *Reading and Writing*, Graham and colleagues (2013) list several research-based factors that should be present in writing instruction. Teachers should provide the following: frequent opportunities for writing, a classroom environment that supports and grows writers, and explicit instruction in the skills, strategies, and knowledge needed for writing. These major components of time, environment, and explicit instruction, along with the collaborative element mentioned in the prior paragraph, are consistently addressed in the research.

## **Writing Assessment**

The consideration of writing assessment naturally accompanies discussions about writing development and instruction since all three components work together to comprise students' writing lives in schools. Just as with most academic testing, the act of assessing writing takes on many forms (e.g., classroom-, school-, district-, state- or national-based; informal or formal; and formative or summative). The National Commission on Writing (2003) argues that there are three key challenges to a writing assessment's success. Students should be judged on several types of writing rather than just one piece, students need adequate time to attend to the writing process, and policymakers and educators should utilize assessment results appropriately. The NWP and Nagin (2003) echo this call. They cite the analysis by Hillocks (2003) of the state assessments in Illinois, Kentucky, New York, and Texas. The state assessments varied as to modes, prompts, stakes, administration, scoring, and criteria.

**Assessment recommendations.** In order for educators to truly assess writing, tests must move beyond short answer and multiple choice formats into extended responses that reflect multiple genres and varied modes of writing, much like the SAT assessment was altered in 2005 (Shaw & Kobrin, 2012). Any rubrics or criteria should clearly and specifically correlate to instructional goals and should be interpreted through the lens of age-appropriate expectations, whether for formative assessments (Panadero & Jonsson, 2013) or for summative assessments (National Assessment Governing Board, 2010). Short answer and multiple choice formats may test knowledge of writing



structures, grammar rules, and editing techniques, but they do not directly assess students' holistic writing skills.

**Implementation statistics for assessments.** In a national survey, Kiuahara, Graham, and Hawken (2009) found that high school teachers of language arts, science, and social studies were most likely to use short answer responses, summaries of readings, and essay exams to assess content. These teachers were less likely to use standardized norm-referenced tests or portfolios. When evaluating student writing, these teachers were more likely to use rubrics and holistic scales to guide their professional judgment. However, these survey results should be viewed within the context of the student report data from the 2007 NAEP results (Applebee & Langer, 2009), which give a more detailed understanding of frequency of use. While high percentages of students reported that they wrote at least one paragraph weekly in their English classes (69% of 8<sup>th</sup> grade students and 77% of 12<sup>th</sup> grade students), these percentages drop sharply when the same statistic was reported for the other three content areas of social studies, science, and mathematics. Students reported the same weekly writing statistic for the other three content areas as follows: social studies at 44% for 8<sup>th</sup> grade and 42% for 12<sup>th</sup> grade, science at 30% for 8<sup>th</sup> and 21% for 12<sup>th</sup>, and mathematics at 13% for 8<sup>th</sup> and 8% for 12<sup>th</sup> (Applebee & Langer, 2009).

### **Specific Contexts for the Current Study**

The previous sections have addressed writing in general through the historical framework of writing research and the multi-faceted existence of students' writing lives in educational settings. This section focuses more specific attention upon writing tasks

in content-area instruction, related reviews—including meta-analytic studies—in the field, and definitions of key terms that are relevant to the current study.

### **Writing Tasks in Content-Area Instruction**

For some researchers and practitioners, the term *content-area instruction* connotes social studies, science, and mathematics classroom teaching. While that connotation persists in some circles, it is important to note that English language arts is a *content*, as well, so it is denotatively included with the other disciplines (e.g., Donahue, 2003; Freedman & Carver, 2007). This is especially true in light of the current standards-based emphasis upon reading informational texts alongside the more traditional genres of literary texts (NGA Center & CCSSO, 2010). Consequently, many writing tasks that are found effective for social studies, science, and mathematics classrooms could also be implemented in the English language arts classrooms.

As discussed earlier in Chapter 1, this more generalized content literacy (Vacca, 2002) provides the foundational reading and writing core to support sets of skills that offer distinct, discipline-specific ways of reading and writing (Shanahan & Shanahan, 2008). Wilson (2011) employs the field of social semiotics to explain how the four content areas—English language arts, social studies, science, and mathematics—exist as “distinguishable communities of practice” (p. 436). Additionally, Wilson characterizes English language arts as a “distinctive discipline,” defined both by the types of texts used and the approaches, jargon, and epistemologies applied to those texts (p. 437). Wilson concludes that a “metadiscursive framework” is necessary for students to learn both across and within the unique disciplines (p. 442).

Moje (2008) advocates a less-partitioned perspective and argues that the focus should be on the abilities of students to engage in authentic discourse across contents rather than on the superficially delineated contents propagated by school cultures. Within a discussion about the Common Core Standards for English Language Arts, Goatley (2012) echoes this point, “Educators will need to think in new ways about authentic teaching across disciplines, both to engage students and to retain the core content of history, science, mathematics, and literature” (p. 18).

Much research has been conducted on the best ways to encourage this authentic engagement across content-area classrooms. In the majority of the research, though, the emphasis has been on reading strategies (e.g., Bean, 2002; Biancarosa, & Snow, 2006; Boardman et al., 2008; Goldman, 2012; Griffin & Tulbert, 1995; Hall, 2005; Kamil, 2003; National Association of State Boards of Education [NASBE], 2006; NICHD, 2000; Scott, 2013; Shanahan & Shanahan, 2008; Simonson, 1995; Slavin et al., 2008). The dominance of content-area reading may inherently reflect a more passive use of content-area literacy. Content-area literacy is incomplete without the incorporation of writing. According to Herbert, Gillespie, and Graham (2013), writing is “one often-overlooked tool for enhancing students’ reading comprehension” (p. 112).

To support this notion that writing critically impacts reading, Herbert et al. (2013) conducted a meta-analysis to compare the effects of several writing tasks upon reading comprehension. These tasks included questions requiring short written responses, multiple-choice questions, written recall of text, written summaries of a text, free-association tasks involving vocabulary words, matching exercises, GIST writing,

essay writing, and idea generation. Herbert and colleagues maintain that “writing activities such as answering questions, note-taking, summary writing, journal writing and essay writing can also be assigned to both assess and extend students’ knowledge of content material” (p. 112). Bangert-Drowns et al. (2004) assert that the mere presence of writing does not guarantee that learning will occur, but that many writing tasks, especially those that encourage metacognition and reflection on content, can positively impact student achievement.

### **Related Reviews of Content-Area Writing**

Although instructional practice can be described theoretically, practitioners want to know which strategies will help their students become more successful with their writing. The following descriptions of prior studies situate the current review within the body of recent research in the area of content-area writing.

**Prior reviews addressing content-area writing.** Graham and Perin (2007a, 2007b, 2007c) offer recommendations of effective strategies evaluated through meta-analysis. For the *Writing Next* report (2007c), only experimental and quasi-experimental studies were included, and the strategies found to have medium to high effect sizes, ranging from 0.5–0.82, were (a) strategy instruction (e.g., SRSD, brainstorming, peer revision, and story writing), (b) summarization, (c) collaborative writing, (d) specific product goals (e.g., for purposes, ideas, and structures), (e) word processing, and (f) sentence combining. Smaller positive effect sizes, ranging from 0.23–0.32, were found for (a) pre-writing, (b) inquiry activities, (c) process-writing approach, (d) study of models, and (e) writing for content-area learning. Isolated grammar instruction was

found to have a significantly negative effect size. However, companion and follow-up publications caution against drawing firm conclusions (Graham & Herbert, 2010; Graham & Perin, 2007a, 2007b; Rogers & Graham, 2008), due to the fact that much writing research does not fit into the strict qualifications for a meta-analysis. Specifically, Graham and Perin (2007b) enhanced the research presented in *Writing Next* with a meta-analysis of single-subject designs and a thematic analysis of qualitative studies to reveal that strategies such as vocabulary instruction and behavioral modification, while not represented by studies that fit their requirements for the initial meta-analysis of experimental and quasi-experimental studies, should also be key elements in writing instruction.

Even though Graham and Perin (2007a, 2007b, 2007c) included studies that examined the effects of writing upon learning of content-area material, Bangert-Drowns et al. (2004) focused on writing to learn more specifically. In their meta-analysis, Bangert-Drowns and colleagues found that writing-to-learn tasks had a positive effect upon school achievement, especially when those tasks were succinct endeavors focused upon metacognition or reflection. While they did find that models of writing and models of learning exhibit many similarities, the authors caution against concluding that writing is synonymous with learning. Learning can occur through many different modes, and simply making students write does not guarantee that learning will occur.

**Extending the previous research.** The current study notably extends and is differentiated from the previous studies discussed in this section in the following four ways: (a) the literature search dates—2000–July 16, 2013—address the intervening years

since the work of Bangert-Drowns et al. (2004); (b) the exclusive focus upon writing tasks in content-area learning streamlines the broader approach taken by Graham and Perin (2007b); (c) the narrowed scope of secondary—grades 6–12—reflects the designation defined by Bangert-Drowns et al. (2004) and standardized by the Common Core Standards for English Language Arts (NGA Center & CCSSO, 2010; see also Parker, 2009); and (d) the systematic literature review methodology is more inclusive of multiple types of studies than the previous meta-analyses.

### **Definitions of Key Terms**

Before offering the specific description of the current study’s methods, several key terms that are used throughout this study are defined to ensure the consistency and transparency of the discussion.

- *Writing*: to produce text as a record of thoughts (Oxford University Press, 2013).

While *writing* can be funneled through multiple modes for a myriad of possible audiences and purposes, the act of *writing* is, at its heart, the act of “thinking on paper” (Zinsser, 1988, p. 11). This definition reflects the construct used by Graham and Perin (2007c,) in their report to the Carnegie Corporation, *Writing Next*. Similar to the current study, these researchers focused on adolescent writers. They acknowledged that *writing* for older students was dependent upon foundational skills such as handwriting and spelling but that those skills were not expressly addressed in secondary-level *writing* instruction. Therefore, Graham and Perin analyzed studies that viewed *writing* as a vehicle for transforming knowledge, as “a way to extend ideas and reasoning” (pp. 23-24). Knowledge-

telling is most typical of less proficient writers and involves writing content that could, in principle, also be conveyed orally. For the purposes of the current study, the concept of *writing* will be operationalized through the qualities of completeness and coherence. In order for a study to qualify as a *writing* study, the activity or strategy being enacted should reflect completeness of thought (e.g., extended responses that go beyond filling out forms or diagrams, such as timelines or fill-in-the-blank worksheets, and typically include grammatically complete sentences of at least one subject and one verb, including varied forms such as, but not limited to, essays, poems, summaries, and reports).

- *Content areas*: distinct academic disciplines in educational settings. *Content-area* separation is a particularly secondary topic, as it is usually applied once schools are partitioned departmentally at around 6<sup>th</sup> grade (Donahue, 2003; Bangert-Drowns et al., 2004), and the areas typically include the major core classes: English language arts, social studies, science, and mathematics. The methods section lists any accepted iterations of these areas for the purposes of the current study's search terms.
- *Content-area literacy*: generalized skills of reading, writing, speaking, viewing, and listening (e.g., summarizing, using evidence to support claims in extended responses, and research-based essays) employed to learn content-area knowledge (Vacca, 2002).
- *Disciplinary literacy*: distinct skills of reading, writing, speaking, viewing, and listening (e.g., lab reports, mathematical-process descriptions, and historical

narratives) particularly relevant to a content area and necessary to achieving more advanced skills in that area (Shanahan & Shanahan, 2008). While Shanahan and Shanahan's work brought attention to the concept of *disciplinary literacy* and is frequently cited to define it, the term was used as early as 2002 by the Institute for Learning at the University of Pittsburgh, according to McConachie et al. (2006). For the purpose of the current study, *disciplinary literacy* is considered one specialized type of *content-area literacy*. For example, within a science classroom, certain writing-to-learn tasks that are specifically aligned to the study of science (e.g., a lab report) would fit both the criteria of *disciplinary literacy* and *content-area literacy*, while others, such as a note-taking strategy, would only fit the criteria of *content-area literacy* due to the multi-disciplinary usefulness of the strategy.

- *Adolescent literacy*: a collective term that refers to the reading, writing, analysis, and discussion skills necessary for adolescents to interact with traditional and multimodal texts across the discipline areas. These skills enable adolescents to both discover and create meaning (IRA, 2012; NCTE, 2006). Although content-area literacy is well aligned with adolescent literacy, it merely represents a subset of the more expansive concept of adolescent-literacy skills.
- *Secondary students/learners*: children in grades 6-12, approximately 11-18 years old. The terms *students* and *learners* are used interchangeably and will both be used as search terms for the current study, although the term *student* will be used in discussion.



- *Empirical*: a term applied to original academic and scientific analyses; a study that is based on observation rather than on theory (Oxford University Press, 2013). The American Psychological Association (2010) explains that articles describing such studies usually contain sections for the introduction, method, results, and discussion, thus illustrating the stages of the research process (p. 10). As long as the study enacts an experiment or observation, either of subjects or of data, then it will be considered empirical for the purposes of this study. Theoretical papers will not be considered for the final corpus of studies but may be used to frame the study and to interpret results.

The following chapters include a description of the specific methods used for the current study, a discussion of the findings of the systematic literature review, and a summary of the current study with limitations, directions for future research, and conclusions.

## **CHAPTER III**

### **METHODS**

#### **Purpose of the Study and Research Questions**

As secondary students and their teachers continually strive to meet the demands of an ever-changing society and ever-increasing knowledge base, the need for stronger and more dynamic literacy skills is paramount (Drew, 2013; Graham & Herbert, 2010; Leu et al., 2011; Morrell, 2013; Vacca, 2002). Students must be equipped to understand new knowledge through well-honed skills. Writing tasks, especially when used to process knowledge through metacognition and reflection, help students to learn that new knowledge in their content-area classrooms (Bangert-Drowns et al., 2004; Graham & Perin, 2007b; Graham & Herbert, 2010). Alvermann (2002) acknowledges that writing can impact students' content-area success beyond mere strategy instruction when she cites Tierney and Shanahan (1991): "Effective teachers look for ways to integrate reading and writing as often as possible because they know that each process reinforces the other and can lead to improved comprehension and retention of subject-area content" (p. 194).

As referenced in the prior chapter, several prior studies (e.g., Bean, 2002; Biancarosa, & Snow, 2006; Boardman et al., 2008; Goldman, 2012; Griffin & Tulbert, 1995; Hall, 2005; Kamil, 2003; NASBE, 2006; NICHD, 2000; Scott, 2013; Shanahan & Shanahan, 2008; Simonson, 1995; Slavin et al., 2008) have reviewed the current research on reading tasks used in content-area instruction. Therefore, to complement

such work, this study systematically reviewed the research on writing tasks in secondary content-area instruction. Studies that were published between January 1, 2000 and July 16, 2013 were retrieved for this review. In a related meta-analysis of writing-to-learn instructional applications, Bangert-Drowns et al. (2004) ended the search for materials in 1999. Therefore, this current study's search commenced where their research ended and employed the same starting point as Graham and Perin (2007c). However, this study expanded on the meta-analytic focus of Graham and Perin by employing the more expansive methodological approach of systematic review, thus allowing for the inclusion of multiple types of empirical studies that are synthesized qualitatively for categories and themes instead of quantitatively for effect sizes. This was a necessary inclusion, according to Graham and Perin (2007b), who contend, "The evaluative lens in writing should have a broad, not narrow, focus in judging the effectiveness of an educational intervention, weighing multiple types of evidence" (p. 327). The following research questions guided this study:

1. What are the prevalent themes in current research on writing tasks in content-area instruction?
2. In what ways does the incorporation of writing tasks into content-area instruction benefit secondary students' content-area learning and knowledge acquisition?
3. According to the research identified in a systematic literature review, what are specific research-based strategies for teachers to use in the effective integration of writing tasks into their instruction?

## **Methodology**

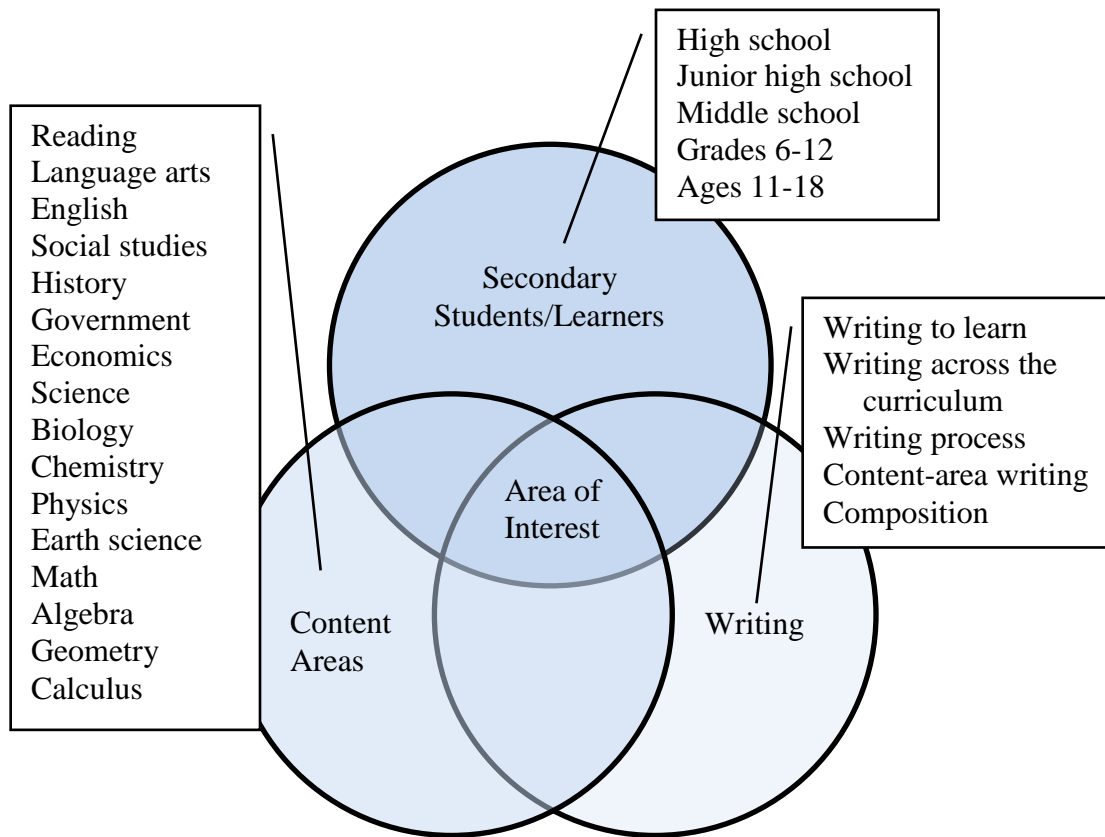
This study employed the methodology of a systematic review (Hannes, Claes, & Belgian Campbell Group, 2007; Risko et al., 2008; Torgerson, 2007) to explore the current research findings about writing instruction in secondary content-area classrooms. This methodology was selected to be more inclusive of multiple types of studies than the previous meta-analyses and to extend that body of research. Specifically, the role of writing in improving student learning and achievement in the areas of English language arts, social studies, science, and mathematics was described through the synthesis of empirical studies that have met the rigorous demands of peer-reviewed academic journals. The protocol of a systematic review involves four phases: (1) the searching for and identification of studies, (2) the multi-step screening of identified studies according to a pre-determined set of inclusionary criteria, (3) the analysis of the selected articles according to a pre-determined set of quality indicators, and (4) the descriptive synthesis of the selected articles in a qualitative overview of the findings (Torgerson, Porthouse, & Brooks, 2005).

### **Literature Search**

The literature search was conducted in two major stages. First, a general database search was performed. A bibliographic search was then carried out to complement the results of the database search.

**Database search.** A comprehensive search of studies published between 2000 and July 16, 2013 was conducted using the ERIC (ProQuest), PsycINFO. 1872-current (ProQuest), Academic Search Complete (EBSCO), and Web of Science (ISI) databases.

In Figure 1, detailed search terms are listed beside the key search terms of *writing*, *content areas*, and *secondary students/learners*. This study's focus area is exhibited where all three of the key terms intersect as visually represented in Figure 1. In addition to these terms, the database searches were expanded using a database thesaurus when one was available (e.g., for the search term of "writing," the PsycINFO. 1872-current (ProQuest) thesaurus was used to include the terms of "Written Communication," "Written Language," "Writing Skills," and "Journal Writing"). Under the guidance of a university research librarian with expertise specifically in systematic literature reviews, the thesaurus terms were used to search entire documents, and the search terms from Figure 1 were used to search the abstract level of the records. The intent of this search was broad—to locate all of the possibly eligible studies which could then be methodically assessed and limited. Ideally, eligible studies addressed writing instruction in secondary content-area classrooms with a focus upon student-based interventions and research. Thus, for instance, studies that concentrated on teacher preparation and professional development were eventually excluded using the selection criteria described in the next section.



**Figure 1.** Diagram of search term clusters.

**Bibliographic search.** Once articles were evaluated according to the selection criteria, the group of selected articles was used to extend the search via Scopus, a citation and abstract bibliographic database, to ensure that all relevant articles were identified. According to Swoger (2013), Scopus enables citation searches through its “scholarly citation chain” (p. 97). Bergman (2013) found that using Scopus alongside Web of Science provided a thorough approach to searching citations. Her research showed that Scopus and Web of Science searches resulted in high percentages of academic journal articles. The Scopus search yielded 83.8% journal articles, and the

Web of Science search yielded 99.7% journal articles. In contrast to these searches, Bergman did find higher numbers of citations through Google Scholar (3,272 versus 2,126 for Scopus and 1,741 for Web of Science), but she cautioned that the diversity of resources retrieved by Google Scholar casts doubt upon the results from that method of searching. The Google Scholar search retrieved only 59.6% academic journal articles. The remaining search results were comprised of dissertations and theses, books, foreign language materials, and miscellaneous items (e.g., reports, course syllabi, unpublished manuscripts, reviews, presentation slides, blogs, and websites). Therefore, Scopus was used to complement the initial searches—those using the ERIC (ProQuest), PsycINFO. 1872-current (ProQuest), Academic Search Complete (EBSCO), and Web of Science (ISI) databases—for the purposes of the current study.

### **Selection Criteria**

All of the studies gathered through the literature search described in the previous section were exported into a research management tool called RefWorks, a web-based bibliographic program chosen upon the recommendation of the university research librarian. All duplicates were excluded. Studies were screened by title and abstract first. Studies were then selected for full-text screening as the final step before analysis. The following inclusionary criteria were used at both junctures: (1) publication—as defined by the two sub-criteria of being written in English and being published between 2000–July 16, 2013; (2) research—as defined by the two sub-criteria of appearing in a peer-reviewed journal and being empirical; (3) topic—addressing writing tasks in content-area instruction; and (4) participants—focusing on secondary students.

**Publication criteria.** The publication criteria existed as an inherent initial screening step. First, all studies had to be published in English. Secondly, the range of publication dates situated this study just after the meta-analysis that provided a framework for this review. Bangert-Drowns et al. (2004) reviewed the literature from 1926–1999. While their review focused on writing-to-learn programs in grades K-12 and college-level classrooms, it did offer a logical starting point for systematically reviewing the past decade of literature in the area of writing tasks in secondary content-area instruction since this study’s target age group, grades 6-12, was explicitly included and delineated.

**Research criteria.** The research criteria guided the second tier of inclusionary criteria. First, the selected studies had to be peer reviewed. Limiting the literature search to peer-reviewed journals acknowledged the rigor of the review process that is the precursor to a study’s appearance in such a journal. While the peer review process is not without its share of limitations and biases, the process does provide a largely effective and generally accepted method to ensure a level of academic credibility of the articles chosen for publication (Albert, Laberge, & McGuire, 2012; Harley, Acord, Earl-Novell, & University of California, Berkeley, Center for Studies in Higher Education, 2010; Nelson, 2011; Roberts & Shambrook, 2012). Secondly, the selected articles had to be empirical; that is, they had to report data from a study. Quantitative, qualitative, and mixed methods studies were acceptable. While theoretical papers, books, book chapters, unpublished papers, and dissertations can provide an invaluable breadth of background



knowledge, the studies included in this systematic review were limited to published, peer-reviewed, empirical studies.

**Topic criterion.** The topic criterion encompassed several generalized topics yet served to focus the selection of articles upon the primary areas of research interest: writing tasks in secondary content-area instruction. Content areas included all common secondary-school variations of English language arts, social studies, science, and mathematics. Because the focus of this study was on learning in these core academic fields, articles that reported research on physical education or foreign language classrooms, for example, were excluded using this criterion. Studies that emphasized writing development (e.g., techniques to improve general writing abilities) and language development (e.g., for students whose primary spoken and written language is not English) over content learning were also excluded using this criterion. Both of these excluded types of articles would provide fruitful directions for additional research, either by expanding or redefining the search criteria used in this study.

**Participants criterion.** The final inclusionary criterion was the secondary school grades of the participants in all selected studies. Due to the self-contained nature of most elementary school classrooms, the delineation of coursework into distinct disciplines does not begin in earnest until 6<sup>th</sup> grade and then continues through high school graduation (Bangert-Drowns et al., 2004). This 6<sup>th</sup> grade shift is reflected in the “Introduction: Key Design Consideration” to the *Common Core Standards for English Language Arts*, in which the authors note that the standards are presented in an integrated form for grades K-5 but are separated for grades 6-12: one section is for

English language arts and the other section addresses history/social studies, science, and technical subjects (NGA Center & CCSSO, 2010; see also Parker, 2009). Since the articles reviewed for the current study exhibited a variety of terminology used to describe participants, the general criterion of secondary students/learners encompassed possible iterations such as school type (high school, junior high school, or middle school), school grade (grades 6-12), and age (ages 11-18).

### **Coding Criteria**

Quantitative and qualitative studies, along with mixed-methods studies, were included in this systematic review of the literature. This decision was a direct response to the implications and limitations discussed by Bangert-Drowns et al. (2004) and Graham and Perin (2007b). When meta-analysis is employed as a methodology, any studies that cannot provide sufficient numerical data for the calculation of effect sizes are automatically excluded from the analysis. Broadening the scope of methodologies eligible for inclusion enabled the exploration of meaning making and causality (Bangert-Drowns et al., 2004; Graham & Perin, 2007b; Risko, et al., 2008).

**Table 1.** Methodological quality indicators (MQI).

Standard	Quality Criteria
<p><b>Standard 1:</b> Provides clear argument that links theory and research and demonstrates coherent chain of reasoning. Explicates theoretical and previous research in a way that builds the formulation of the question(s).</p>	<p><b>1.1</b> Explicates theory and/or previous research in a way that builds the formulation of the posed question(s)/purpose(s)/objective(s) that can be investigated empirically.</p> <hr/> <p><b>1.2</b> Explicitly links findings to previous theory and research or argument for study.</p>
	<p><b>2.1</b> Ensures that methods are presented in sufficient detail and clarity to clearly visualize procedures (e.g., another person could actually collect the same data). Data collection should be described so that readers can replicate the procedures in a quantitative study or follow the trail of data analysis in a qualitative study. For a qualitative study, researcher(s) should report some of the following: number of observations, interviews, or documents analyzed; if interviews and observations are taped and/or transcribed; duration of observations; diversity of material analyzed; and degree of investigator's/s' involvement in data collection and analysis.</p>
<p><b>Standard 2:</b> Applies rigorous, systematic, and objective methodology to obtain reliable and valid knowledge relevant to educational activities and programs.</p>	<p><b>2.2</b> Provides evidence of <i>reliability</i>. Was this evidence provided for the data collected (e.g., describe coefficients, test-retest, Cronbach's alpha)? Did researcher(s) provide information about instrument development and study populations (e.g., content-area writing strategies)? For qualitative studies, were characteristics of reliability, credibility, and/or trustworthiness addressed and reported?</p>
	<p><b>2.3</b> Provides evidence of <i>validity</i>. Was this evidence provided for the data collected (e.g., does the instrumentation measure what it is designed to measure and accurately perform the intended function)? Is there information about instrument development and adaptations for specialized populations (e.g., content-area writing strategies)? For qualitative studies, were characteristics of reliability, credibility, and/or trustworthiness addressed and reported?</p>
	<p><b>2.4</b> Describes participants. Was the sample well characterized (e.g., the age/grade and the type of content area)?</p>
<p><b>Standard 3:</b> Presents finding(s) and makes claims that are appropriate to and supported by the methods that have been employed.</p>	<p><b>3.1</b> Findings and conclusions are legitimate or consistent with data collected.</p>

*Note.* Adapted from *Every Teacher a Teacher of Reading?: A Systematic Literature Review of Content-Area Literacy* by C. E. Scott, 2013, unpublished doctoral dissertation, Texas A&M University, College Station, TX. Reprinted with permission. See also Acosta & Garza, 2011; Risko, et al., 2008.

**Coding for quality.** Each study selected for inclusion using the methodology described above was analyzed for quality using seven quality indicators (Scott, 2013; see also Acosta & Garza, 2011; Risko et al., 2008). The indicators addressed the theoretical and research base of the study; the clarity, reliability, and validity of the study; and the consistency and appropriateness of the study's findings.

The researcher applied the seven quality indicators to each study using the template in Table 1, the methodological quality indicators (MQI). Each study was scored using the following values: 3—meets all seven indicators, 2—meets between four and six indicators, and 1—meets between zero and three indicators (Scott, 2013; see also Risko et al., 2008). For a study to be included in the final corpus of articles, then it had to meet all seven quality indicators and receive a score of “3.”

**Interrater reliability.** A second rater's assistance was enlisted to ensure the reliability of the quality coding of the studies. The second rater, an assistant professor of teaching and learning at a separate southwestern, Research I university, possesses an extensive background of teaching and writing about content-area literacy instruction and has employed the methodology of systematic literature reviews in recent research projects. The second rater scored a randomized sample of the studies using the MQI. Any discrepancies were revisited and discussed until consensus was reached to yield a final score. Percent of agreement was calculated for interrater reliability, with the minimum goal being 85% agreement. This was calculated by taking the number of agreements over the number of agreements plus disagreements. That result was multiplied by 100 to obtain the scores for interrater reliability.

The two remaining chapters include a discussion of the findings of the systematic literature review and a summary of the study with limitations, directions for future research, and conclusions.

## **CHAPTER IV**

### **FINDINGS**

Chapter III of the current study described the structure of the methodology employed. This chapter contains the results of the research steps taken in the systematic literature review. In the first section, the descriptive results of the overall searching, screening, and coding are presented. The second section provides the results of the qualitative analysis of the studies by categories and themes.

#### **Results of Data Analysis**

The systematic literature review process began with a structured search of electronic databases. This search was followed by a screening protocol governed by several inclusionary criteria. Next, the studies that passed through the screening steps were coded for quality. These steps are described in this section.

#### **Systematic Search**

As described in the previous chapter, the final corpus of studies was identified for relevance and analyzed for quality using the methodology of a systematic review (Hannes et al., 2007; Risko et al., 2008; Torgerson, 2007). First, a comprehensive search of four databases was performed using the search terms listed in Figure 1 (found in Chapter III of the current study). These terms served to focus the search on the research topic of writing tasks in the secondary content-area classroom.

The search of the ERIC (ProQuest), PsycINFO. 1872-current (ProQuest), Academic Search Complete (EBSCO), and Web of Science (ISI) databases yielded

3,435 possible studies. Based on their availability within each interface, limiters matching the previously discussed inclusionary criteria, such as the range of publication dates, were applied via the databases' search engines before the records were exported to RefWorks.

Additionally, this preliminary search process was revisited following the full-text screening step. The bibliographic database Scopus was used to trace the citation paths of the articles that made it through the full-text screening phase and were later coded for quality. Any possibly applicable records were exported to RefWorks for further analysis. This expanded database search added an additional 126 records.

The combined total for all exported records was 3, 561. Once 690 duplicates were removed, 2,871 records progressed to the screening phase of the systematic review. The results of this step are enumerated in Table 2.

**Table 2.** Record retrieval breakdown.

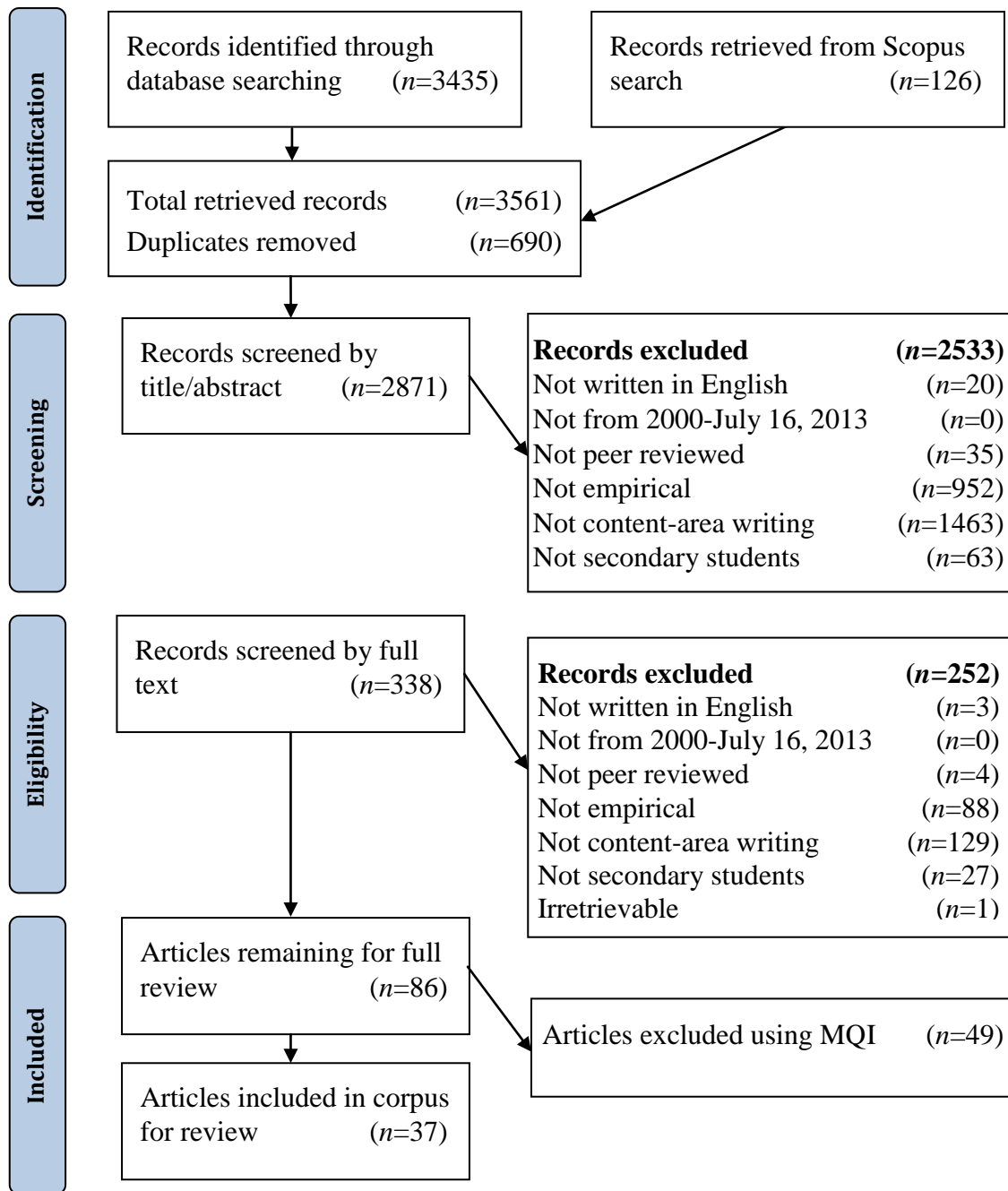
<b>Retrieval Source</b>	<b>Initial Search</b>	<b>Limiters Applied</b>	<b>Retrieved Records for Screening</b>
PsycINFO 1872-current (a ProQuest database of psychological sources)	1165	peer reviewed, 2000-2013	323
ERIC (a ProQuest database of the Educational Resources Information Center)	6668	peer reviewed, 2000-2013	1894
Academic Search Complete (an EBSCO database)	1182	scholarly, 2000-2013	518
Web of Science (a Thomson Reuters database)	869	2000-2013	700
SciVerse Scopus	126	none	126

## Screening Steps

After all records were exported to RefWorks and duplicates were identified and removed, the multi-step screening process began. Figure 2 illustrates the screening process using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Guide (Moher, Liberati, Tetzlaff, Altman, & PRISMA Group, 2009).

**Title- and abstract-level screening.** First, all records were analyzed by title and abstract using the previously described inclusionary criteria. While Figure 2 exhibits the numerical totals of the screening and coding processes, the specific distributions of excluded records merits further discussion. The first three criteria—being written in English, published between 2000 and July 16, 2013, and peer reviewed—only accounted for 2.2% ( $n=55$ ) of the 2,533 excluded records. This relatively low percentage directly reflects the way the database searches were enhanced with any applicable limiters as shown in Table 2. The fourth criterion, which specified that all the studies be empirical, excluded 37.6% ( $n=952$ ) of the records screened. Some of the excluding abstracts were theoretically oriented, but more of the excluded items were practitioner oriented and did not contain all of the main elements of a research study, such as appropriately identified participants and clearly defined outcomes. The fifth criterion, which addressed the relevance to the content-area writing topic, excluded the largest portion of records, 57.8% ( $n=1463$ ). According to the final criterion, included studies had to focus on secondary students. This focus excluded 2.5% ( $n=63$ ) of the records. After the title- and abstract-level screening, 338 articles moved to the full-text screening step. This represents 11.7% of the 2,871 articles screened at the first level.





**Figure 2.** Flow diagram of article selection process. Adapted from “Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement,” by D. Moher, A. Liberati, J. Tetzlaff, and D. G. Altman, 2009, *PLoS Medicine*, 6(7), pp. 1-6.

**Full-text screening.** For the full-text screening level, the researcher retrieved the studies as Adobe® Portable Document Format (PDF) files when possible. This preferred type of file enables the full text to be viewed exactly as it appeared in the originally published format; therefore, headings, figures, and tables are displayed accurately. When the PDF files were not available, HTML files were screened. Only one article was designated as “irretrievable” since neither the researcher nor the library’s interlibrary loan service was able to locate it within a reasonable amount of time using electronic interlibrary requests and attempts to contact the author (approximately one month).

The inclusionary criteria applied during the title- and abstract-level screening were also used in the full-text screening of 338 articles. As a result, a total of 252 were excluded. The distribution of exclusions among the criteria was similar to the percentages reported for the first screening level. The first three criteria excluded 2.8% ( $n=7$ ) of the 252 total exclusions. Criterion 4 excluded 34.9% ( $n=88$ ), criterion 5 excluded 51.2% ( $n=129$ ), and criterion 6 excluded 10.7% ( $n=27$ ). This percentage for criterion 6 exhibited a notable increase of 8.2% from the 2.5% that was excluded during the title- and abstract-level screening. While the abstracts of studies often gave cursory or vague descriptions of the participants, a full-text screening often specifically revealed that the data were actually collected from participants who were too young (below the 6<sup>th</sup> grade), from participants who were too old (post-secondary), or from the teachers rather than from the students. As portrayed in Figure 2, the full-text-level screening excluded 74.6% of the 338 screened articles. This narrowed the review’s focus to 86 articles.

## **Coding for Quality**

The 86 articles that emerged from the screening process were then analyzed according to the predetermined set of quality indicators shown in Table 1 (found in Chapter III of the current study). The application of quality indicators was enhanced for reliability with the involvement of a second rater.

**Quality indicators.** The quality coding eliminated 60% ( $n=49$ ) of the studies. While there were lower quality coding scores for several of the MQI's criteria, the most notable area of low scores (41.3%,  $n=36$ ) was Criterion 2.2, the evidence of reliability of the data collected for a study. Low scores for this criterion reflect that the reliability statistics were not reported for the instruments used in quantitative studies. The final corpus of studies identified through the quality coding process contained 37 articles. The studies and their key characteristics are summarized in the Appendix.

**Interrater reliability.** As described in Chapter III of the current study, a qualified second rater's assistance was enlisted to ensure the reliability of the quality coding of the studies. The second rater scored a randomized sample of the studies using the MQI. Of the 86 studies, 10% ( $n=9$ ) were scored for the purposes of calculating interrater reliability. After any discrepancies were revisited and discussed for consensus, percent of agreement was calculated for interrater reliability, with the minimum goal being 85% agreement (as calculated by dividing the number of agreements by the number of agreements plus disagreements and multiplying the result by 100).

The interrater reliability was calculated for the following three dimensions of coding: (1) overall inclusion and exclusion of articles; (2) total score, wherein a "3"

indicates the article met all 7 quality criteria listed in Table 1, a “2” indicates 4-6 criteria, and a “1” indicates 0-3 criteria; (3) variable agreement, wherein the ratings for the 7 quality criteria for each of the 9 articles provided a set of 63 variables. The first dimension of interrater reliability was calculated based on the number of articles included in the final corpus of 37 articles. The percent of agreement obtained was 100%. For the second dimension of coding, the score level, the interrater reliability obtained was 77.8% (7 of the 9 scores reflected agreement). Although this percentage falls below the previously stated minimum goal of 85% for interrater reliability, it should be noted that the only disagreements were between the disqualifying scores of “1” and “2.” Therefore, the score-level disagreements had no impact upon the total number of articles receiving the qualifying score of “3” and thus marked for inclusion in the final corpus of 37 articles. Finally, for the third dimension of coding, the variable level, the interrater reliability percentage obtained was 88.9% (56 of the 63 variables reflected agreement).

### **Synthesis of Articles**

The most crucial step of the systematic literature review involves a descriptive synthesis of the selected articles and a qualitative overview of the findings by categories and themes (Torgerson et al., 2005). This type of synthesis supports the overall goal of the current study, which was to “increase an understanding of the phenomena” rather than to report statistical results (Gall, Gall, & Borg, 2007, p. 120; see also Graham & Perrin, 2007c). The final 37 articles were analyzed to discover common themes of the research foci and findings (Risko et al., 2008). The thematic analysis revealed a

foundational pattern for the next step, which was an inductive analysis to identify categories that could encapsulate the varied themes in a logical manner for examination. The remainder of this chapter contains a discussion of the descriptive characteristics of the final corpus of 37 studies followed by a thematically organized discussion of each of the identified categories.

### **Descriptive Characteristics of Studies**

During the data analysis process, each study that was determined to have a quality score of “3” was summarized for certain descriptive characteristics (see the Appendix for the complete list of 37 articles). The characteristics included the following areas: participants and setting, research methods, data sources, data analysis, research foci, and study findings. All of these characteristics are analyzed in this section with the exception of the last two. In the following sections, the research foci and study findings are discussed using the themes and categories that emerged during analysis.

**Participants.** The key search terms for the current study included “secondary students/learners.” As was discussed in the previous chapter, that term includes students in grades 6-12. Since the search was not limited to the United States, other countries’ designations of grade levels often varied. Terms such as “Year 7” (Choi, Notebaert, Diaz, & Hand, 2010) and “upper secondary” (Christenson, Rundgren, & Hoglund, 2012) were interpreted into grade-level ranges by the researcher to create consistency in the reporting of the findings. For the purposes of describing the findings in a more unified way, the following designations were developed: lower secondary (grades 6-8, ages 11-14, and years 6-8) and upper secondary (grades 9-12, ages 14-18, and years 9-12).

Although the age of 14 falls into both ranges, the studies were categorized by the characteristics of the majority of the participants. Of the final corpus of articles, 27.0% ( $n=10$ ) were lower secondary, 64.9% ( $n=24$ ) were upper secondary, and 8.1% ( $n=3$ ) were evenly mixed between the two designations. The larger emphasis of research in the upper secondary designation directly reflected the movement described by Bangert-Drowns et al. (2004), wherein the self-contained classrooms of elementary school are delineated into separate classes of subject areas beginning in the 6<sup>th</sup> grade. These separate classes are increasingly defined as the grades progress, so it is understandable that research on specific content areas, as is the focus of this study, would gravitate toward the more sharply defined courses taught during the upper secondary years.

**Content areas.** The search criteria for the current study also included possible core-content variations for the broad term of “content areas” (see Figure 1). The majority of the studies included in the final corpus researched one content area in isolation (89.2%,  $n=33$ ), thus reflecting the movement from self-contained classrooms to discipline-specific classrooms as described in the previous paragraph. However, 10.8% ( $n=4$ ) of the studies researched classes of hybrid content areas: two studies that combined social studies/history and reading/language arts, one study that combined science and social studies/history, and one that combined science and mathematics. Of the 33 studies that researched one content area in isolation, 54.1% ( $n=20$ ) focused on science, 16.2% ( $n=6$ ) on social studies/history, 10.8% ( $n=4$ ) on reading/language arts, and 8.1% ( $n=3$ ) on mathematics.

**Locations.** The parameters of the search terms and inclusionary criteria allowed for studies to be included without specific regard to location; however, the first inclusionary criterion of being written in English certainly influenced the possible locations of the studies that underwent the screening process. This was evident in the distribution of locations for the studies included in the final corpus. The United States was the locale for 59.5% ( $n=22$ ) of the studies. The remaining studies were from Canada and Germany (each had 10.8%,  $n=4$ ), from the Netherlands and Turkey (each had 5.4%,  $n=2$ ), and from Korea, New Zealand, and Sweden (each had 2.7%,  $n=1$ ).

**Research methods and data analyses.** The research methods and the data analyses used provided the final source of descriptive characteristics for the discussion in this section. The 37 studies included in the final corpus represented multiple methodologies, wherein 45.9% ( $n=17$ ) were quantitative, 40.5% ( $n=15$ ) were mixed methods, and 13.5% ( $n=5$ ) were qualitative. These methodologies were applied to the following general categories of data sources: writing samples, such as essays, reports, and journal entries (83.8%,  $n=31$ ), assessments (45.9%,  $n=17$ ), interviews and oral responses (32.4%,  $n=12$ ), questionnaires and surveys (18.9%,  $n=7$ ), field notes and observations (13.5%,  $n=5$ ), and prior grades/achievement in similar courses (10.8%,  $n=4$ ). This enumeration of data sources should not be totaled since it reflects that multiple data sources were used by many of the studies. Only 18.9% ( $n=7$ ) of the studies employed a single source of data, and all of these studies used students' writing samples as that data source.

These data sources were analyzed either quantitatively or qualitatively, but enumeration totals that follow reflect the overlapping effect of the number of studies classified as mixed-methods studies. The types of analyses were taken from the direct verbiage used in the studies and were categorized using the explanations offered by Gall and colleagues (2007). Of the total corpus of 37 studies, 86.5% ( $n=32$ ) used one or more examples of quantitative analysis: descriptive statistics ( $n=8$ ), correlational statistics ( $n=13$ ), and tests of statistical significance ( $n=36$ ). Descriptive statistics included the reporting of standard deviation, mean, and distribution of codes. Correlational statistics included bivariate and multivariate, multiple regression, regression slopes, time series analysis, and hierarchal linear modeling. Tests of statistical significance included parametric measures (e.g., *t*-test, ANOVA, ANCOVA, and MANOVA) and nonparametric (e.g., chi square, tests of independence and association, and percentage of non-overlapping data [PND]).

Of the total corpus of 37 studies, 54.1% ( $n=20$ ) used one or more examples of qualitative analysis. Whether used as a stand-alone act of analysis or as a clarification for quantitative results reported, the qualitative analyses used coding schemes and rubrics applicable to the studies' research questions. Coding methods analyzed topics such as categories and patterns ( $n=12$ ), thinking operations ( $n=7$ ), and themes ( $n=7$ ). Just as was noted in the previous paragraphs in reference to data sources, this enumeration of data analyses reflects the multiple analyses used by individual studies and should not be totaled. The prevailing use of multiple methods shows the complex approach taken by



many of the studies. In summary, a strength of research in this area is that a variety of methodologies are applied, which are captured within the systematic literature review.

### **Analysis of Studies by Categories and Themes**

Next, the findings are presented in the categories and/or themes that emerged during analysis (see Table 3). When conducting a thematic analysis of the final corpus of 37 studies, 15 possible themes were identified: (a) the impact of planning and revising strategies, (b) the delivery of the assignment (explicit or otherwise), (c) types of writing tasks, (d) frequency of writing tasks, (e) models for prewriting, (f) metacognition, (g) assessing metacognition through journals, (h) writing's enhancement of talking and reasoning, (i) effect of audience, (j) qualities of the discipline, (k) achievement, (l) limits of writing's benefits, (m) type of understanding, (n) formative assessment, and (o) writing about issues to promote engagement. Next, the themes were reviewed to determine broader categories for grouping. Three categories emerged from this grounded analysis: context—*how* the writing task was articulated, taught, and/or implemented in the instructional setting; cognition—*why* the writing task enhanced and exposed thinking; and content—*what* discipline-specific knowledge and skills were demonstrated through the writing task. These categories and themes were viewed through the lenses of both content literacy and disciplinary literacy. As suggested by Vacca (2002), content literacy is defined as using the cross-curricular literacy skills of reading, writing, speaking, viewing, and listening, while disciplinary literacy is defined as learning more specialized content through discipline-specific ways of knowing (Shanahan & Shanahan, 2008).

**Table 3.** Organization of categories and themes.

<b>Categories</b>	<b>Themes</b>
CONTEXT <i>How</i> the writing task was articulated, taught, and/or implemented in the instructional setting	The impact of planning and revising strategies The delivery of the assignment (explicit or otherwise) Types of writing tasks Frequency of writing tasks Models for prewriting
COGNITION <i>Why</i> the writing task enhanced and exposed thinking	Metacognition Assessing metacognition through journals Writing’s enhancement of talking and reasoning Effect of audience
CONTENT <i>What</i> discipline-specific knowledge and skills were demonstrated through the writing task	Qualities of the discipline Achievement Limits of writing’s benefits Type of understanding Formative assessment Writing about issues to promote engagement

Since 94.6% ( $n=35$ ) of the 37 studies were linked to multiple themes, the studies were thematically analyzed once more to ensure accuracy, and each study was assigned to the category that best fit the research foci, study findings, and identified themes. The category of context pertained to 48.6% ( $n=18$ ) of the studies, cognition to 29.7% ( $n=11$ ) of the studies, and content to 21.6% ( $n=8$ ) of the studies (see Table 4). However, it should be noted that achievement, a theme included in the content category, was evident in 64.9% ( $n=24$ ) of the studies and is a pervasive theme throughout the final corpus of studies. In the following sections, the findings from each of these three categories—context (the conditions in which the writing tasks were assigned), cognition (the thinking made evident in the writing tasks), and content (the discipline-specific learning revealed by the writing tasks)—are reported using the thematic subgroups.

**Table 4.** Categories and themes of content-area writing research (shaded areas indicate categorical placements).

Study	Content Area	Context	Cognition	Content
Akkus, R., Gunel, M., & Hand, B. (2007)	Science	Model for pre-writing Delivery of the assignment		Achievement
Alev, N. (2010)	Science			Limits of writing's benefits Type of understanding
Beck, S. W. & Jeffery, J. V. (2009)	Humanities (history and literature)	Types of writing tasks		Limits of writing's benefits Type of understanding
Buxton, C. A., Alleksaht-Snider, M., Suriel, R., Kayumova, S., Choi, Y., Bouton, B., & Baker, M. (2013)	Science			Achievement Formative assessment
Choi, A., Notebaert, A., Diaz, J., & Hand, B. (2010)	Science	Model for pre-writing		
Christenson, N., Rundgren, S. C., & Høglund, H. (2012)	Science			Writing about issues to promote engagement
Conner, L. N. (2007)	Science		Metacognition Assessing metacognition through journals	
Cross, D. I. (2009)	Math		Writing enhances talking	Achievement
De La Paz, S., Ferretti, R., Wissinger, D., Yee, L., & MacArthur, C. (2012)	Humanities (history and literature)	Model for pre-writing Delivery of the assignment		Writing about issues to promote engagement
De La Paz, S. & Felton, M. K. (2010)	History	Model for pre-writing Delivery of the assignment		
Glogger, I., Holzäpfel, L., Schwonke, R., Nückles, M., & Renkl, A. (2009)	Math		Metacognition Assessing metacognition through journals	Limits of writing's benefits
Glogger, I., Schwonke, R., Holzäpfel, L., Nückles, M., & Renkl, A. (2012)	Math and Science		Metacognition Assessing metacognition through journals	Achievement

**Table 4.** Continued.

<b>Study</b>	<b>Content Area</b>	<b>Context</b>	<b>Cognition</b>	<b>Content</b>
Grimberg, B. I. & Hand, B. (2009)	Science	Model for pre-writing	Metacognition	Achievement
Gunel, M., Hand, B., & McDermott, M. A. (2009)	Science		Metacognition Effect of audience	Achievement Type of understanding
Hand, B., Hohenshell, L., & Prain, V. (2004)	Science	Model for pre-writing Frequency of tasks	Metacognition Effect of audience	
Hand, B., Wallace, C. W., & Yang, E. (2004)	Science	Model for pre-writing Types of writing tasks	Metacognition	Achievement Type of understanding
Haugwitz, M., Nesbit, J. C., & Sandmann, A. (2010)	Science	Types of writing tasks		Achievement
Hohenshell, L. M. & Hand, B. (2006)	Science	Model for pre-writing		Achievement
Hübner, S., Nückles, M., & Renkl, A. (2010)	Psychology		Metacognition Journal writing	Achievement
Keselman, A., Kaufman, D. R., Kramer, S., & Patel, V. L. (2007)	Science		Writing enhances reasoning	Achievement Writing about issues to promote engagement
Keys, C. W. (2000)	Science	Model for pre-writing	Metacognition	Achievement
Kieft, M., Rijlaarsdam, G., & van den Bergh, H. (2006)	Literature	Types of writing tasks Planning and revising		Achievement
Kieft, M., Rijlaarsdam, G., & van den Bergh, H. (2008)	Literature	Types of writing tasks Planning and revising		Achievement
Kingir, S., Geban, O., & Gunel, M. (2012)	Science	Model for pre-writing		Achievement
Klein, P. D. & Rose, M. A. (2010)	Science	Delivery of the assignment	Metacognition	Achievement
Knaggs, C. M. & Schneider, R. M. (2012)	Science	Model for pre-writing Frequency of tasks		Type of understanding
Lewis, W. E. & Ferretti, R. P. (2011)	Literature	Delivery of the assignment		Achievement Qualities of the discipline

**Table 4.** Continued.

<b>Study</b>	<b>Content Area</b>	<b>Context</b>	<b>Cognition</b>	<b>Content</b>
McDermott, M. A. & Hand, B. (2013)	Science	Delivery of the assignment		Achievement Type of understanding
Monte-Sano, C. (2008)	History	Delivery of the assignment	Writing enhances reasoning	Achievement Qualities of the discipline
Monte-Sano, C. (2010)	History			Type of understanding Qualities of the discipline
Monte-Sano, C. (2011)	History	Delivery of the assignment		Achievement Formative assessment Qualities of the discipline
Monte-Sano, C. & De La Paz, S. (2012)	History	Types of writing tasks	Writing enhances reasoning	Achievement
Nam, J., Choi, A., & Hand, B. (2011)	Science	Model for pre-writing Delivery of the assignment		Achievement
Pugalee, D. K. (2001)	Math		Metacognition	Formative assessment
Reynolds, G. A. & Perin, D. (2009)	History	Delivery of the assignment		Achievement
Rivard, L. P. (2004)	Science		Writing enhances talking	Achievement
Wong, B., Kuperis, S., Jamieson, D., Keller, L., & Cull-Hewitt, R. (2002)	Literature	Types of writing tasks	Assessing metacognition through journals	Achievement

**Findings on context.** First, the findings within the category of context are presented thematically. The applicable themes included the major themes of models for prewriting, and instructional delivery of the assignment along with the additional, minor themes of the types of writing tasks, the impact of planning and revising strategies, and the frequency of writing tasks. This discussion is followed by a summarization of the commonalities across themes.

*The category of context.* The first category of studies, context, was conceptualized as *how* the writing task was taught, articulated, and/or implemented in the instructional setting. Context included the method of instructional delivery as well as the specific formulation and presentation of the writing task. The themes grouped into this category of context included models for prewriting and the delivery of the assignment (explicit or otherwise), types of writing tasks, the impact of planning and revising strategies, and frequency of writing tasks. Figuratively speaking, the articles that fit thematically into the context category focused on the pedagogical and logistical birthplaces of the writing tasks being researched (e.g., how the writing task was conceptualized, presented, and implemented). These articles represented 48.6% ( $n=18$ ) of the final corpus of studies. While the findings are reported as they related to the themes in the category of context, see Table 5 for the more precise details of each study.

**Table 5.** Summaries of studies—context.

Study	Participants and Setting Population, Number, Location	Research Method(s) and Data Source(s)	Data Analysis	Research Focus	Study Findings
Akkus, R., Gunel, M., & Hand, B. (2007)	Group 1: <i>N</i> = 7 science teachers, grades 7-11 (chemistry, physics, and biology), classes divided into 11 control and 12 treatment Group 2: <i>N</i> =592 students, 270 control and 322 treatment Location: United States	MIXED Group 1: quality of teacher implementation evaluated qualitatively using video-taped lessons and observations Group 2: student achievement evaluated quantitatively using student test scores	Group 1: interpretive case study Group 2: ANOVA and ANCOVA	Traditional instruction in science classrooms vs. an inquiry approach using the Science Writing Heuristic (SWH)	The quality of teachers' implementation of the SWH impacts student achievement and high-quality implementation of the SWH helps to close the achievement gap.
Choi, A., Notebaert, A., Diaz, J., & Hand, B. (2010)	<i>N</i> =107 students (13 Year 5, 38 Year 7, and 56 Year 10) (296 total science writing samples) Location: United States	QUANTITATIVE Student writing samples	Samples scored for Total Argument and Holistic Argument and analyzed with multiple stepwise linear regression	The use of the Science Writing Heuristic (SWH) to assist students' development of arguments	The SWH framework helps students to construct evidence-based claims.
De La Paz, S., Ferretti, R., Wissinger, D., Yee, L., & MacArthur, C. (2012)	<i>N</i> =70 8th grade students in integrated social studies and language arts setting Location: United States	MIXED Students' essays (from two teams) analyzed quantitatively; interviews with students analyzed qualitatively	Pre- and posttest essay scores analyzed for 4 characteristics via ANOVA; interview transcripts described for historical understanding and confidence with the model	The use of a historical reasoning strategy/model to improve historical argumentative essay writing	The instruction on historical reasoning and argumentative writing skills produced more accurate and persuasive writing by students in the experimental team.

**Table 5.** Continued.

Study	Participants and Setting Population, Number, Location	Research Method(s) and Data Source(s)	Data Analysis	Research Focus	Study Findings
De La Paz, S. & Felton, M. K. (2010)	N=160 11th grade U.S. History students (4 groups, 1 control and 1 experimental at 2 schools) Location: United States	QUANTITATIVE Student writing samples	Pre- and posttest essay scores analyzed for 6 characteristics via ANOVA and ANCOVA	The use of a historical reasoning strategy/model to improve historical argumentative essay writing	The instruction on historical reasoning, argumentative writing skills, and use of evidence produced more accurate and persuasive writing by students in the experimental groups.
Hand, B., Hohenshell, L., & Prain, V. (2004)	N=73 10th grade biology students (4 classes) Location: United States	MIXED Baseline grades, students' written responses, and assessments analyzed quantitatively; student interviews analyzed qualitatively	Previous semester's grades, writing task scores, and posttest scores analyzed using ANCOVA; semi-structured interviews coded for patterns of students' perceptions	The effects of planning and frequency of writing-to-learn tasks upon students' learning outcomes	Planning tasks deemed useful without significant regard to timing, and writing more than once (to an authentic audience) increased students' learning outcomes.
Hand, B., Wallace, C. W., & Yang, E. (2004)	N=93 7th grade biology students (5 classes) Location: United States	MIXED Assessments analyzed quantitatively; student interviews analyzed qualitatively	Reading diagnostic test and science-related pre- and posttest scores analyzed using ANCOVA; semi-structured interviews transcribed and coded for emerging categories	The impact of two writing-to-learn tasks upon students' conceptual and metacognitive science understandings	Non-traditional writing-to-learn tasks improved students' conceptual knowledge and metacognition of science understanding.



**Table 5.** Continued.

Study	Participants and Setting Population, Number, Location	Research Method(s) and Data Source(s)	Data Analysis	Research Focus	Study Findings
Haugwitz, M., Nesbit, J. C., & Sandmann, A. (2010)	N=248 secondary biology students (average age: 13.88 years) divided into 77 groups Location: Germany	QUANTITATIVE Assessments, biology grades, and students' summary scores (for either essays or concept maps)	Pre- and posttest, cognitive abilities test, and summary scores analyzed using ANOVA and ANCOVA	The interaction of cognitive ability and collaboration with the type of summarization method used (essay or concept mapping)	Concept mapping, while an effective summarization method for students of all ability levels, is especially beneficial for the learning outcomes of students with lower cognitive abilities.
Hohenshell, L. M. & Hand, B. (2006)	N=91 mostly-9th grade advanced biology students (4 classes) Location: United States	MIXED Baseline grades and assessments analyzed quantitatively; surveys and student interviews analyzed qualitatively	Previous unit test grades, pre-test scores, and 2 posttest scores analyzed using ANCOVA and chi-square; open-ended surveys and semi-structured interviews coded for themes	The use of the Science Writing Heuristic (SWH) as a pre-writing activity for writing a summary report and how linking the two writing-to-learn tasks impacts student learning outcomes	Students who used the SWH instead of the traditional lab report as a precursor to a summary report exhibited greater ownership and achievement of the learning outcomes.

**Table 5.** Continued.

Study	Participants and Setting Population, Number, Location	Research Method(s) and Data Source(s)	Data Analysis	Research Focus	Study Findings
Kieft, M., Rijlaarsdam, G., & van den Bergh, H. (2006)	N=113 10th grade literature students (5 classes) Location: Netherlands	QUANTITATIVE Questionnaires, students' written responses and workbook activities, lesson evaluations	Questionnaires of planning and revising strategies, pre- and posttest literary interpretations, workbook activities, and lesson evaluations analyzed using correlation, interaction, and ANOVA	The effectiveness of adapting writing-to-learn tasks to writing strategies, either planning or revising, when teaching literature	Planning strategies improve literary interpretation skills in writing-to-learn tasks.
Kieft, M., Rijlaarsdam, G., & van den Bergh, H. (2008)	N=220 10th grade literature students (8 classes) Location: Netherlands	QUANTITATIVE Questionnaires, students' written responses, lesson evaluations	Questionnaires of planning and revising strategies, pre- and posttest literary interpretations, and lesson evaluations analyzed with descriptive statistics and regression slopes for effects of aptitude/ treatment interaction	The interaction of writing to learn about literary stories with either planning or revising writing strategies	Adapting the writing-to-learn task to the appropriate strategy increases students' learning outcomes.

**Table 5.** Continued.

Study	Participants and Setting Population, Number, Location	Research Method(s) and Data Source(s)	Data Analysis	Research Focus	Study Findings
Kingir, S., Geban, O., & Gunel, M. (2012)	<i>N</i> =122 9th grade chemistry students Location: Turkey	QUANTITATIVE Semester averages, assessments	The students' chemistry grades from the previous semester and pre- and posttest scores analyzed with ANOVA and ANCOVA	The effectiveness of using the Science Writing Heuristic (SWH) in improving student learning outcomes	Use of the SWH significantly closes the science-learning achievement gap between low- and high-achieving students.
Klein, P. D. & Rose, M. A. (2010)	<i>N</i> =34 5th and 6th grade science students (2 classes) with a focus on 7 students from the experimental class Location: Canada	QUANTITATIVE Multiple assessments (pre- and posttests surrounding formative assessments and ongoing treatment decisions) in a "design experiment"	Pre- and posttests for approach to writing (survey), genre knowledge (survey), and argument and explanation quality (writing samples) analyzed with MANOVA	Implementing the knowledge transformation model through argumentative and explanatory writing-to-learn tasks	Situated cognition enabled students to move from rhetorical to content problem solving when given argumentative and explanatory writing-to-learn tasks.
Knaggs, C. M. & Schneider, R. M. (2012)	<i>N</i> =50 9th grade biology students Location: United States	MIXED Students' Vee map responses and lab report scores analyzed quantitatively; survey responses analyzed qualitatively	Vee map and lab report scores coded using rubrics and reported through descriptive statistic bar graphs; ANOVA, and correlation; survey responses categorized and tallied	The repeated effects of using a Vee map on students' science process and concept understandings as shown through the Vee map responses, lab reports, and surveys	Repeated use of Vee maps to scaffold students' lab experiences supported increased process and concept learning as shown through the Vee map responses, lab reports, and surveys.

**Table 5.** Continued.

Study	Participants and Setting Population, Number, Location	Research Method(s) and Data Source(s)	Data Analysis	Research Focus	Study Findings
Lewis, W. E. & Ferretti, R. P. (2011)	N=6 10th and 11th grade English students Location: United States	QUANTITATIVE Students' written responses	Baseline, target, and non-target writing probes coded for functional and non-functional units of meaning and scored for quality then analyzed using Percentage of Non-overlapping Data (PND)	The Self-Regulated Strategy Development (SRSD) instruction in two topoi to impact the quality and evidence use in literary argumentative writing	SRSD instruction in literary topoi improves the quality of argument and the use of textual evidence in students' literary argumentative writing.
McDermott, M. A. & Hand, B. (2013)	Case 1: N=70 10th, 11th, and 12th grade chemistry students (3 classes) Case 2: N=95 10th, 11th, and 12th grade chemistry students (5 classes) Location: United States	QUANTITATIVE Assessments and students' written responses	Scores (for baseline science assessment and writing sample, 2 unit writing assignments and 2 unit assessments- only 1 for Case 2) analyzed on the group level using <i>t</i> -tests, ANCOVA, and effect size and on the individual level using correlations and regression analysis	The effect of embeddedness in multimodal writing upon conceptual chemistry understanding and the impact of instructional supports for multimodal writing	When students are explicitly instructed on embeddedness, students' multimodal writing and conceptual understanding improves.

**Table 5.** Continued.

Study	Participants and Setting Population, Number, Location	Research Method(s) and Data Source(s)	Data Analysis	Research Focus	Study Findings
Monte-Sano, C. & De La Paz, S. (2012)	N=68 10th grade World History students (8 classes) and 33 11th grade U.S. history students (3 classes) Location: United States	QUANTITATIVE Students' assessments, class work, and written responses	Pretest and document work scores analyzed using ANOVA; essays scored for historical writing ability and reasoning using a rubric; all combined and analyzed with MANOVA and regression analyses	Four different writing prompts administered to determine the most effective prompt types for historical perspectives and reasoning	Writing prompts that focus on sourcing, corroboration of documents, and causation are more effective than imaginative prompts for improving students' historical writing outcomes.
Nam, J., Choi, A., & Hand, B. (2011)	N=345 8th grade science students (11 classes) Location: Korea	QUANTITATIVE Assessments and students' written responses	Science reasoning assessment, Reformed Teaching Observation Protocol (RTOP), and Summary Writing Test (SWT) scores analyzed using ANCOVA and effect size	The impact of the Science Writing Heuristic (SWH) approach upon students' content-area writing	Students who were taught using the SWH approach (in high levels of implementation) performed significantly better on summary writing tasks.

**Table 5.** Continued.

Study	Participants and Setting Population, Number, Location	Research Method(s) and Data Source(s)	Data Analysis	Research Focus	Study Findings
Reynolds, G. A. & Perin, D. (2009)	N=121 7th grade social studies students (6 classes) Location: Canada	QUANTITATIVE Assessments and students' written responses	The scores of 2 diagnostic assessments and pre- and posttests of content knowledge, along with a pretest and 3 posttests of writing summarizations, analyzed using ANCOVA and pair-wise post hoc comparisons	The use of text structure instruction (TSI) and a planning strategy (PWS) in teaching students to compose from expository text structures	The use of TSI and PWS instruction improved students' performance when writing expository text summary and positively impacted students' content-area knowledge.

***Models for prewriting.*** The most prevalent theme of this category was the use of models and templates for prewriting, including the Science Writing Heuristic (SWH), the historical reasoning strategy, and Vee maps. The SWH, an inquiry-based approach to writing lab reports which contains questions for both the teacher and the students, was the subject of eight studies. The templates of the SWH address the thought processes activated at the following six points during the laboratory experiment: (1) questions, (2) test and collect data/observation, (3) claims, (4) evidence, (5) reading, and (6) reflection (Nam, Choi, & Hand, 2011). Overall, the SWH was shown to increase student achievement in content learning, which was measured on various domains (Akkus, Gunel, & Hand, 2007; Choi et al., 2010; Hand, Wallace, & Yang, 2004; Hohenshell & Hand, 2006; Kingir, Geban, & Gunel, 2012; Nam et al., 2011; see also Grimberg & Hand, 2009; Keys, 2000). Specifically, half of the studies examined the instructional impact of the SWH on students' scores on content-area assessments (Akkus et al., 2007; Hand, Wallace, et al., 2004; Kingir et al., 2012), while the other half analyzed students' abilities to construct arguments (Choi et al., 2010) or to exhibit stronger content knowledge in summarization tasks (Hohenshall & Hand, 2006; Nam et al., 2011).

A second model of prewriting, the historical reasoning strategy, was the subject of two studies. The historical reasoning strategy model contains the following four steps to guide students' historical thinking: (1) consider the author, (2) understand the source, (3) critique the source, and (4) create a more focused understanding (De La Paz & Felton, 2010). Both studies showed that this prewriting model improved students' historical argumentative essay writing, although it should be noted that the same primary researcher

conducted the two studies (De La Paz & Felton, 2010; De La Paz, Ferretti, Wissinger, Yee, & MacArthur, 2012).

A final prewriting model, Vee maps, was the research focus of one study. According to Thoron and Myers (2010), the Vee map is a tool developed by Gowin in 1977 to guide learners through the steps of scientific reasoning. Knaggs and Schneider (2012) showed that using Vee maps, graphic organizers that group “knowing” and “doing” tasks around the scientific question, helped to improve students’ process and concept learning.

Finally, in contrast to the previous studies whose purpose was to directly evaluate a specific prewriting strategy, Hand, Hohenshell, and Prain (2004) indirectly addressed prewriting with 73 10<sup>th</sup> grade biology students. Rather than implementing a specific strategy, the researchers examined the impact of varying the timing of prewriting (referred to in the study as “planning”) tasks between the beginning of a task or at a later point in the writing process. Results of writing task scores and content-area assessments indicated that students benefitted from planning tasks without regard to the placement of these tasks within the writing process.

In total, these results indicated that contextualizing content-area writing tasks with prewriting activities helped to improve students’ content knowledge, as evidenced by either traditional assessments or writing scores. It should be noted that the majority of the activities discussed in this section, the SWH and the historical reasoning strategy, align with the disciplinary literacy approach in which students engage in the type of writing that professionals in the field would do (Shanahan & Shanahan, 2008). However,



the majority of such studies investigated one model of pre-writing activities and more research is needed on additional models.

***Instructional delivery of the assignment.*** Another major theme for the category of context was the instructional delivery of the assignment. Typically, this instructional delivery was in the form of explicit strategy instruction, but this theme also encompassed more philosophy- or principle-based approaches. What is common amongst all these studies is that they examined a specific pedagogical approach. Six of the studies characterized by this theme depicted explicit strategy instruction as a support for increased student learning (De La Paz & Felton, 2010; De La Paz et al., 2012; Klein & Rose, 2010; Lewis & Ferretti, 2011; McDermott & Hand, 2013; Reynolds & Perin, 2009). Although two studies (Klein & Rose, 2010; McDermott & Hand, 2013) simply referred to their researched instructional models as cognitive-based strategy instruction, the other studies (De La Paz & Felton, 2010; De La Paz et al., 2012; Lewis & Ferretti, 2011; Reynolds & Perin, 2009) all specifically characterized their researched instructional models as Self-Regulated Strategy Development (SRSD, see Graham & Perin, 2007c). Explicit strategy instruction increased student performance in content-area writing tasks such as argumentative essays (De La Paz & Felton, 2010; De La Paz et al., 2012; Klein & Rose, 2010; Lewis & Ferretti, 2011) and in content-area assessments of conceptual learning (McDermott & Hand, 2013; Reynolds & Perin, 2009).

Two additional studies showed the impact of disciplinary philosophy upon the instructional delivery of the assignment (Akkus et al., 2007; Nam et al., 2011; see also Monte-Sano, 2008, 2011). Disciplinary philosophy was operationalized as the teaching

of a discipline as a source of inquiry and interpretation rather than as a collection of inarguable facts. This inquiry-based approach resulted in the improvement of students' content-area knowledge (Akkus et al., 2007) and content-area writing performance (Nam et al., 2011).

The studies focusing on explicit strategy instruction were more prevalent in the final corpus of articles, but the studies examining inquiry showed promising results, as well. Within both explicit strategy instruction and inquiry-based approach, one goal is that the students eventually grow to apply the strategy independently or think independently about the task. The inquiry-based approach also encourages students to think independently. Overall, these studies demonstrated that pedagogical contexts could impact student performance in content-area writing if those contexts encouraged students' independence through either strategy implementation or exploratory inquiry.

***Additional themes.*** This category contained three minor themes. Five studies showed the effects of varying the types of writing tasks (Hand, Wallace, et al., 2004; Haugwitz, Nesbit, & Sandmann, 2010; Kieft, Rijlaarsdam, & van den Bergh, 2006, 2008; Monte-Sano & De La Paz, 2012; see also Beck & Jeffery, 2009; Wong, Kuperis, Jamieson, Keller, & Cull-Hewitt, 2002). In general, these researchers found that the types of writing tasks must be directly relevant to the intended learning in order to positively impact students' learning, which is a logical finding. For example, Hand, Wallace, et al. (2004) and Haugwitz et al. (2010) found that non-traditional writing tasks, such as concept-mapping, encouraged deeper cognitive engagement and improved the students' learning outcomes. In another example of fitting the task to the desired learning

outcome, Monte-Sano and De La Paz (2012) found that students' reasoning and argumentative abilities in history were enhanced by writing to prompts that were more evidence-based queries rather than more imaginative in concept.

Two studies depicted the impact of planning and revising strategies, two common components in writing instruction. Although related to the major theme of models for prewriting discussed above, these studies were distinct since they also examined the impact of revising strategies. Kieft et al. (2006, 2008) studied five 10<sup>th</sup> grade literature classes and found that planning helped students to demonstrate more content-area learning through writing tasks than did the use of revision.

Observations about the frequency of writing tasks were the focus of two studies (Hand, Hohenshell, et al., 2004; Knaggs & Schneider, 2012). These researchers showed that increasing the frequency of writing tasks increased students' learning outcomes. Hand, Hohenshell, et al. (2004) found that students who wrote multiple times to an authentic audience showed improved scores on both content-area assessments and writing tasks. Similarly, Knaggs and Schneider (2012) showed that repeated use of Vee maps to scaffold students' lab experiences supported increased process and concept learning.

*Summary of commonalities across themes.* The studies in the context category did not depict a singularly ideal instructional setting; however, key recommendations were revealed in the analyses of science, social studies, and English language arts classrooms. First, the studies' findings clearly support the use of prewriting models and the value of planning writing tasks. Secondly, an inquiry-based philosophy of the discipline and explicit strategy instruction were both shown to improve students' learning

outcomes. Finally, the research revealed that the logistical implementation of the content-area writing tasks matters in terms of student achievement. Writing tasks should be directly relevant to the desired learning outcomes, and writing assignments were shown to be more beneficial when assigned regularly.

**Findings on cognition.** The findings within the second category of cognition are presented thematically. The applicable themes included metacognition, assessing metacognition through journals, and writing's enhancement of talking and reasoning. This discussion is followed by a summarization of the commonalities across themes.

***The category of cognition.*** The second category of studies, cognition, included those studies that examined the thinking exposed by the content-area writing tasks. Instead of emphasizing the nature of the task like the studies in the context category, cognition was conceptualized as the students' perceptions of *why* they wrote as they did. The studies used data sources such as think-alouds during the writing task (usually recorded and transcribed), interviews, and learning journals to examine the thought processes that undergird students' performance in content-area assessments. The cognition category contained the themes of metacognition, assessing metacognition through journals, and writing's enhancement of talking and reasoning. This category of articles represented 29.7% ( $n=11$ ) of the final corpus of studies. While the findings are reported as they related to the themes in the category of cognition, see Table 6 for the more precise details of each study.

**Table 6.** Summaries of studies—cognition.

Study	Participants and Setting Population, Number, Location	Research Method(s) and Data Source(s)	Data Analysis	Research Focus	Study Findings
Conner, L. N. (2007)	N=16 high-school biology students; 3 were featured as case studies Location: New Zealand	QUALITATIVE Student interviews, journal entries, essays, and classroom observations; case studies	Pre- and post interviews, class work, journals, and essays evaluated for awareness/use of strategies; case studies revealed how the students used the strategies	How teachers can scaffold students' metacognitive strategies and students' thinking as shown in writing	When teachers prompt metacognitive thinking about strategies, students learn more effectively and produce higher-quality essays.
Cross, D. I. (2009)	N=211 9th grade math students and 5 teachers Location: United States	MIXED Assessments for 4 groups (3 experimental and 1 control) analyzed quantitatively; transcripts of classroom activities, discussions, and students' papers analyzed qualitatively	Pre-and posttests analyzed via ANCOVA; bi-weekly observation transcripts and students' writing analyzed to clarify quantitative results in more detail	How argumentation discourse and writing can improve students' achievement in mathematics	The argumentation-writing and writing-only groups showed the highest level of achievement (over the argumentation-only and control groups).
Glogger, I., Holzäpfel, L., Schwonke, R., Nückles, M., & Renkl, A. (2009)	N=44 9th grade mathematics students (2 classes) Location: Germany	QUANTITATIVE Student journal writing samples	Journal entries coded for quantity and quality of learning strategies and recorded (MANOVA and <i>t</i> -tests)	The specificity of prompts and the quantity and quality of the journal responses produced	Increased specificity of prompts elicited higher quantities of learning strategies in journal responses; however, the quality of the learning strategies leaves room for improvement.

**Table 6.** Continued.

Study	Participants and Setting Population, Number, Location	Research Method(s) and Data Source(s)	Data Analysis	Research Focus	Study Findings
Glogger, I., Schwonke, R., Holzäpfel, L., Nückles, M., & Renkl, A. (2012)	Study 1: <i>N</i> =236 9th grade mathematics students (10 classes) Study 2: <i>N</i> =144 9th grade biology students (8 classes) Location: Germany	QUANTITATIVE Assessments of prior and learned knowledge, questionnaires on motivation, and student journal writing samples	Pre- and posttest scores, questionnaire results, and journal entries coded for the quantity and quality of learning strategies recorded (hierarchical linear modeling, correlations, and ANOVA)	The relationship between the quality and quantity of learning strategies recorded by students in learning journals and learning outcomes	Strategy-based responses in learning journals affect learning outcomes with correlations shown between outcomes and the quantity and quality of strategies recorded.
Grimberg, B. I. & Hand, B. (2009)	<i>N</i> =33 7th grade Life Science students (21 high-achieving, 12 low-achieving) Location: United States	MIXED Students' lab reports analyzed qualitatively; scores analyzed quantitatively	Reports coded for reasoning operations; tests of independence/ association for cognitive levels and achievement levels using chi-square analysis	The relationship of achievement levels and cognitive pathways for students using the Science Writing Heuristic (SWH) to write lab reports	Although the pathways slightly differ, both low- and high-achieving students exhibit higher-level cognitive operations when using the SWH to write lab reports.
Günel, M., Hand, B., & McDermott, M. A. (2009)	<i>N</i> =20 9th grade and 98 10th grade biology students (4 classes) Location: United States	QUANTITATIVE Assessments and students' written responses	Pre- and posttest scores analyzed using ANOVA, ANCOVA, and MANOVA; writing tasks analyzed using stepwise linear regression	The impact of writing-to-learn tasks upon student learning and the impact of audience upon cognitive planning	Writing-to-learn tasks increase students' science understanding, especially when the designated audience requires richer explanations.

**Table 6.** Continued.

<b>Study</b>	<b>Participants and Setting</b> Population, Number, Location	<b>Research Method(s) and Data Source(s)</b>	<b>Data Analysis</b>	<b>Research Focus</b>	<b>Study Findings</b>
Hübner, S., Nückles, M., & Renkl, A. (2010)	N=70 secondary psychology students (mean age: 17.62) (4 groups) Location: Germany	QUANTITATIVE Assessments and students' written responses	Topic specific pre-(1) and posttest (2) scores and coded amount of evident strategy use analyzed using ANOVA	How the use of informed prompting and models impacts the learning outcomes of journal writing	Students who were given informed prompts and models for writing their learning journals exhibited higher posttest scores.
Keys, C. W. (2000)	N=16 8th grade earth science students Location: United States	QUALITATIVE Students' think-aloud recordings and written lab reports	Audiotapes of students' think-alouds transcribed and coded for categories; written lab reports were coded for scientific thought processes then holistically assessed	An examination of the thinking processes used by students writing laboratory reports when supported by the Science Writing Heuristic (SWH)	For students who engaged in mental reflection during the writing process, written laboratory reports stimulated science learning.
Pugalee, D. K. (2001)	N=20 9th grade algebra students Location: United States	QUALITATIVE Students' written responses	Students' written descriptions of processes were coded for problem-solving phases and metacognitive behaviors	The evidence of metacognitive behaviors in students' written records of problem solving	Results show that students exhibited metacognitive behaviors throughout all four problem-solving phases.

**Table 6.** Continued.

Study	Participants and Setting Population, Number, Location	Research Method(s) and Data Source(s)	Data Analysis	Research Focus	Study Findings
Rivard, L. P. (2004)	N=154 8th grade science students (8 classes) Location: Canada	MIXED Assessments analyzed quantitatively; peer discussions and students' written responses analyzed qualitatively	Pre- and post-test (2) scores analyzed using repeated measures and planned comparisons/ contrasts analysis; transcribed discussions coded and explanatory writing samples scored with a rubric	The impact of achievement level upon the effectiveness of talk and writing descriptive and explanatory tasks	Low achievers demonstrated higher learning outcomes when talk preceded the measure, but high achievers benefitted more from explanatory writing.
Wong, B., Kuperis, S., Jamieson, D., Keller, L., & Cull-Hewitt, R. (2002)	N=48 12th grade English students (3 classes) Location: Canada	MIXED Assessments, student self-rating form analyzed quantitatively; student interviews analyzed qualitatively	Two posttests (character and theme) analyzed using ANOVA; ratings from responses analyzed descriptively; interview responses analyzed for themes	The effects of two types of guided journal writing upon students' understanding and appreciation of a complex novel	Students who wrote character- or thematic-based journal entries scored significantly better on posttests over a complex novel.



***Metacognition.*** The majority of the studies in this category depicted research on metacognition and its relation to content-area writing tasks (Conner, 2007; Glogger, Holzäpfel, Schwonke, Nückles, & Renkl, 2009; Glogger, Schwonke, Holzäpfel, Nückles, & Renkl, 2012; Grimberg & Hand, 2009; Gunel et al., 2009; Hübner, Nückles, & Renkl, 2010; Keys, 2000; Pugalee, 2001; see also Hand, Hohenshell, et al., 2004; Hand, Wallace, et al., 2004; Klein & Rose, 2010). The term metacognition, as used in these studies, refers to “the monitoring of one's mental activities” (Pugalee, 2001). The synthesis of these studies aligned with the findings of a prior meta-analysis by Bangert-Drowns and colleagues (2004), which showed metacognition to have a positive impact on student achievement. Building upon the conclusions of that study, these more recent studies considered the question of how to facilitate students’ metacognitive writing.

Overall, the studies indicated that teachers have a significant role in prompting metacognitive strategies; however, these studies demonstrated the effects of this prompting through different measures. One group of studies focused on how metacognitive strategies are revealed through students’ writing. Glogger and colleagues (2009) evaluated the quality of metacognitive strategies found in 9<sup>th</sup> grade mathematics students’ journal entries and found that increasing the specificity of teachers’ prompting resulted in an increased presence of high-quality strategies in the students’ journal entries. Likewise, Pugalee’s (2001) research with 9<sup>th</sup> grade algebra students showed that guided prompts encouraged metacognitive strategy use at each of the four problem-solving steps as proven by students’ journal entries written at each step. Furthermore, since the intent of the Science Writing Heuristic (SWH) described in the context

category is to promote inquiry-based thinking, its use to promote metacognition was understandably depicted in two studies (Grimberg & Hand, 2009; Keys, 2000). When researching similar groups of participants (Grimberg and Hand with 7<sup>th</sup> grade life science; Keys with 8<sup>th</sup> grade earth science), both studies examined students' lab reports and found that students used more metacognitive strategies when the SWH prompted and structured their thinking.

Another group of studies focused on how the use of metacognitive strategies served as a precursor to improved content-area student achievement, as evidenced by both writing-intensive and more traditional assessments. When researching writing tasks with high-school biology students, Conner (2007) did examine the students' actual journal entries but placed more emphasis on the final written product, an essay, and concluded that the journaling of metacognitive strategies acted as a scaffold for improving students' formal writing outcomes. Similarly, Hübner et al. (2010) explored how metacognitive journaling acted as a foundation for improving the content-area posttest scores of high school psychology students. In studying 9<sup>th</sup> grade mathematics and biology students, Glogger and colleagues (2012) also found that when students were asked to expose their thinking through strategy descriptions, students' learning outcomes on content-area assessments were positively impacted.

Finally, Gunel and colleagues (2009) researched the effects of manipulating the intended audience for content-area writing tasks. The high-school science students were asked to explain an aspect of the nervous system to students (peers and younger) and to adults (teachers and parents). When the students were asked to reconfigure their writing

approaches to suit the younger, assumingly less-knowledgeable audiences, they showed increased metacognitive activity and improved learning outcomes in their attempts to explain the process more explicitly.

Generally, the studies described above showed that prompting students to expose their thought processes was a crucial scaffold and precursor to improved learning.

***Assessing metacognition through journals.*** The most prevalent method of assessing metacognitive strategy use is through the analysis of students' journal entries. Many of the studies listed in the previous section drew from journals as data sources (Conner, 2007; Glogger et al., 2009; Glogger et al., 2012; Hübner et al., 2010; Keys, 2000; Pugalee, 2001; Wong et al., 2002). The importance of the prompts used to elicit cognitive strategies was advocated in several studies (Conner, 2007; Glogger et al., 2009; Hübner et al., 2010; Wong et al., 2002). For instance, in their research with 12<sup>th</sup> grade English language arts and reading students, Wong and colleagues (2002) showed that students who wrote guided journal entries focused on either character or theme scored significantly better on posttests over a complex novel. Furthermore, Glogger et al. (2012) found that higher student achievement in both mathematics and science classes was directly correlated to evidence of higher quantities and qualities of the learning strategies as recorded by the students in their journals. In summary, journals were shown to be both a tool for prompting metacognitive writing and a source of evidence for documenting levels of metacognitive writing.

***Writing's enhancement of talking and reasoning.*** In two of the studies, content-area writing tasks were advocated as a means to bolster students' cognitive

abilities to talk and reason in the learning environment. Cross (2009), found that when oral argumentation was combined with a writing task that general education 9<sup>th</sup> grade students showed higher achievement on mathematics assessments. Rivard's (2004) research with 8<sup>th</sup> grade science students more complex and ability-differentiated results. Lower-achieving students benefitted more from engaging in oral discussions when completing explanatory writing tasks, while higher-achieving students showed similar amounts of improvement when the explanatory writing tasks were not supported by oral discussions. Therefore, although both studies showed the benefits of asking students to discuss topics before writing about them, Rivard (2004) showed that the benefits impacted lower-achieving students more distinctly. However, this area is in need of more research before conclusions can be drawn. For instance, the different results could have resulted from the disciplinary characteristics of math versus science.

*Summary of commonalities across themes.* All of the studies thematically included in the cognition category provided a broad overview of the beneficial role content-area writing tasks in improving students' cognitive activity. Although students do not naturally take metacognitive stances and analyze their learning, the research showed that purposeful teaching could encourage students to do just that. In general, tools such as specific writing prompts for journals and combining oral discussions with writing tasks helped to improve students' learning outcomes.

**Findings on content.** The findings within the third category of content are presented thematically. The applicable themes included achievement, formative assessment, the disciplinary conversation, and the types of understanding along with

writing's limitations. This discussion is followed by a summarization of the commonalities across themes.

***The category of content.*** The third and final category of studies, content, was the more discipline-specific category. Articles that fell into this category depicted ways of considering *what* the students learned in each content area and *what* discipline-specific knowledge and skills were demonstrated through the writing tasks. Instead of emphasizing the context of how writing tasks are conceived and implemented (as with the context category) or examining the thinking processes prompted and revealed during the writing tasks (as with the cognition category), the content category contained studies that were more focused on the outcomes of the writing tasks and content-area assessments. In this category more than the previous two, the more specialized elements of disciplinary literacy (Shanahan & Shanahan, 2008) overshadowed the more overarching elements of content-area literacy (Vacca, 2002). The content category primarily contained the theme of achievement, but it also included articles that addressed formative assessment, continued engagement, qualities of the discipline, types of understanding, and the limits of writing's benefits. This category of articles represented 21.6% ( $n=8$ ) of the final corpus of 37 studies. However, as was mentioned earlier in this chapter, the theme of achievement appeared in 64.9% ( $n=24$ ) of the studies. While the findings are reported as they related to the themes in the category of content, see Table 7 for the more precise details of each study.

**Table 7.** Summaries of studies—content.

Study	Participants and Setting Population, Number, Location	Research Method(s) and Data Source(s)	Data Analysis	Research Focus	Study Findings
Alev, N. (2010)	N=2 physics teachers, 42 physics students Location: Turkey	MIXED Case study including questionnaires, observational field notes, student responses, and semi-structured interviews	Likert-scale questionnaires analyzed for mean; interviews, notes, and responses coded for themes	Value of reading and writing in science and improvements in conceptual understanding	Reading and writing activities improved students' conceptual understanding and engagement but did not improve procedural or computational skills.
Beck, S. W. & Jeffery, J. V. (2009)	N=7 10th grade students and 4 11th grade students, Humanities (history/literature combination) course Location: United States	QUALITATIVE Retrospective, structured interviews along with excerpts of students' writing	Descriptive (a priori) and interpretive coding of interviews and excerpts of students' writing	Students' ability to subjectively identify themes for analytical writing and how alternate genres could help this thinking	When writing analytical expository essays, students found interpretive stances difficult. Other genres may help bridge the way to academic genres.
Buxton et al. (2013)	N= 11 science teachers (1 4th grade, 1 5th grade, 2 6th grade, 3 7th grade, and 4 8th grade) and 757 4th-8th grade students Location: United States	MIXED Students' assessment results analyzed quantitatively and teachers' interviews and written responses evaluated qualitatively	Pre- and posttest results equated and then analyzed for correlations; teachers' responses grouped by similarities	The use of writing-intensive educative assessments to increase instructional emphasis upon science understandings	The educative assessments enabled teachers to more accurately instruct in the areas of inquiry, content, and academic language.

**Table 7.** Continued.

Study	Participants and Setting Population, Number, Location	Research Method(s) and Data Source(s)	Data Analysis	Research Focus	Study Findings
Christenson, N., Rundgren, S. C., & Hoglund, H. (2012)	N=80 upper secondary students (40 science majors and 40 social science majors) Location: Sweden	QUANTITATIVE Student writing samples	Samples scored for 18 possible sentence-level codes and analyzed for distribution across a sociocultural framework (SEE-SEP) and knowledge, value, and personal experience (KVP) categories	How the SEE-SEP framework intersects with KVP to show students' use of argumentation and evidence in writing	Using socioscientific issues (SSIs) can enhance students' multidisciplinary engagement in science.
Keselman, A., Kaufman, D. R., Kramer, S., & Patel, V. L. (2007)	N=61 7th grade science students Location: United States	MIXED Assessments and reasoning tasks analyzed quantitatively; students' written and oral responses analyzed qualitatively	Pre- and posttest scores, and coded task responses analyzed using ANOVA, chi-square, and McNemar tests; excerpts from student's writing and transcribed oral responses qualitatively offer support for statistical findings	The impact of critical reasoning tasks and writing activities upon students' knowledge, understanding, and reasoning about real-life scientific issues	Students who engaged in both reasoning and writing activities exhibited higher learning outcomes than those students who engaged in reasoning tasks only or were part of the control group.

**Table 7.** Continued.

Study	Participants and Setting Population, Number, Location	Research Method(s) and Data Source(s)	Data Analysis	Research Focus	Study Findings
Monte-Sano, C. (2008)	N=42 high school U.S. history students (2 classes) with 2 students used as case studies Location: United States	MIXED Students' written responses analyzed quantitatively; interviews, observations, teacher feedback, assignments, readings analyzed qualitatively	Pre- and posttest writing sample scores compared using standard deviation and mean; other data sources organized chronologically and coded for themes and trends using time-series analyses; 2 students' essays closely analyzed using rubric	The types of instruction used to support students when writing evidence-based history essays	A constructivist approach to teaching history as interpretation supports students in writing and reasoning skills for improved learning outcomes.
Monte-Sano, C. (2010)	N=56 11th grade U.S. history students (3 classes) Location: United States	QUALITATIVE Students' written responses	Students' essays analyzed and coded for historical thinking and argument structure	Defining disciplinary literacy components of history writing	Five trends of historical writing emerged: accuracy, persuasiveness, sourcing, corroboration, and contextualization of evidence.



**Table 7.** Continued.

Study	Participants and Setting Population, Number, Location	Research Method(s) and Data Source(s)	Data Analysis	Research Focus	Study Findings
Monte-Sano, C. (2011)	N=15 11th grade U.S. history students with 3 students used as case studies Location: United States	MIXED Students' written responses analyzed quantitatively; regularly assigned tasks, interviews, observations, teacher feedback, artifacts analyzed qualitatively	Pre- and posttest writing sample scores compared using standard deviation and mean; other data sources organized chronologically and coded for themes and trends using time-series analyses; 3 students' essays closely analyzed using a rubric	The discipline-specific literacy instruction of one teacher and the impact upon the students' historical reasoning and writing	When history is taught using the historical-interpretative view that emphasizes evidence use, perspective recognition, and interpretation, students' historical writing improves.

***Achievement.*** The most pervasive theme found in the corpus of 37 articles was achievement (see Cross, 2009; Glogger et al., 2012; Grimberg & Hand, 2009; Gunel et al., 2009; Hand, Wallace, et al., 2004; Haugwitz et al., 2010; Hohenshell & Hand, 2006; Hübner et al., 2010; Keys, 2000; Kieft et al., 2006, 2008; Kingir et al., 2012; Klein & Rose, 2010; Lewis & Ferretti, 2011; McDermott & Hand, 2013; Monte-Sano & De La Paz, 2012; Nam et al., 2011; Reynolds & Perin, 2009; Rivard, 2004; Wong et al., 2002).. However, of the 24 studies that included the theme of achievement, there were four studies that depicted research focused mainly on achievement (Buxton et al., 2013; Keselman et al., 2007; Monte-Sano, 2008, 2011). These four differ from the other studies in that the research depicted a closer examination of the formal assessments and the summative results of those assessments.

Specifically, in the area of science, Keselman and colleagues (2007) showed that the use of critical reasoning tasks combined with content-area writing tasks as precursors to content-area assessments positively impacted the 7<sup>th</sup> grade science students' demonstrated knowledge, understanding and reasoning about a "real-life issues" (p. 845), such as HIV and AIDS. Also in the science discipline, Buxton et al. (2013) found that manipulating the assessments themselves to be more writing intensive increased the amount of scientific understanding that was demonstrated by the middle-school science students they studied.

Both studies by Monte-Sano (2008, 2011) examined the impact of disciplinary philosophy upon assessment results. When 11<sup>th</sup> grade U. S. History students were taught through a more interpretive lens, they performed better on the U. S. History Advanced

Placement exam-type document-based questions than students who were taught with a more traditional, facts-oriented philosophy.

The relationship between writing and formal content-area assessments was shown to be a beneficial one. When used to prepare for assessments, content-area writing tasks positively impacted student achievement (Keselman et al., 2007; Monte-Sano, 2008, 2011), and when the actual assessment was converted to a content-area writing task, students exhibited greater levels of understanding (Buxton et al., 2013). On the whole, content-area achievement was shown to increase when writing tasks were incorporated into either the preparation for or the actual format of the assessments.

***Formative assessment.*** While achievement is a typical summative outcome of formal assessments, as described in the previous section, researchers and teachers also use assessment results formatively to adjust the next instructional steps. In other words, summative assessment results are used to measure student achievement, whereas formative assessment results are used to gauge and direct instructional plans. Only two articles specifically indicated the value of content-area writing tasks to formulate and adapt instructional directions (Buxton et al., 2013; Monte-Sano, 2010; see also Pugalee, 2001). Monte-Sano (2010) analyzed the historical writing task responses of 11<sup>th</sup> grade U. S. History students to determine which components of historical thinking and argument structure should define historical writing instruction. The students' writing responses to document-based questions were used to directly modify the way the teachers approached writing instruction in the disciplinary area of history. Likewise, Buxton et al. (2013) used the results of writing-intensive assessments to inform the

teachers of middle-school science students and to enable those teachers to more accurately instruct in the areas of inquiry, content, and discipline-specific academic language.

***The disciplinary conversation.*** Several researchers addressed the goal of engaging students in the larger disciplinary conversation, one that extends beyond classroom assignments. The theme of writing about issues to promote engagement was addressed by two articles (Christenson et al., 2012; Keselman et al., 2007; see also De La Paz et al., 2012). Christenson et al. (2012) analyzed students' writing responses about the socioscientific issues of global warming, genetically modified organisms, nuclear power, and consumption to assess their reasoning sources. The researchers studied how the categories of knowledge, values, and personal experiences intersected with students' use of argumentation and evidence in writing and found that students' values greatly inform their expressions of scientific literacy. For example, students used values (67%) to support their claims over scientific knowledge (27%), which led the authors to conclude that students viewed scientific knowledge as "uncontested" and not appropriate to use for support in argumentation tasks (Christenson et al, 2012, p. 351). Keselman et al. (2007) examined the role of critical reasoning activities and writing tasks in increasing students' conceptual and critical understandings of HIV and AIDS and showed how science writing fostered knowledge integration in other content areas such as health.

A second theme that relates to a larger view of disciplinary knowledge is the qualities of the discipline and was seen in the work of Monte-Sano (2008, 2010, 2011).

Through extensive analyses of students' writing responses and observations of successful teachers in the field of history, Monte-Sano sought to define the disciplinary literacy components of history writing. In a qualitative analysis of students' written responses to document-based questions, the researchers developed a coding system that reflected the disciplinary concepts traditionally found in history writing, such as argument, context, and evidence. Specifically, Monte-Sano (2010) concluded that five trends of historical writing emerged from the students' writing responses: accuracy, persuasiveness, sourcing, corroboration, and contextualization of evidence (see also Lewis & Ferretti, 2011).

The studies included in this theme of the disciplinary conversation all served to place the purposes of the content-area writing tasks within each discipline's unique ideological framework. While students' values and abilities to reason impacted their scientific writing abilities, students' understanding and use of historical evidence influenced their writing tasks in history classes. These discipline-specific definitions of literacy served as frameworks for analyzing students' writing. As Monte-Sano (2010) posited, "Historical writing is not just about literacy" (p. 563). Logically, the same could be said for writing in science, mathematics, and language arts (see Moje, 2008).

*Types of understanding and writing's limitations.* Finally, research in the content category indicated that content-area writing tasks could reveal students' types of understanding but that there were limits to writing's benefits. There were two studies that addressed the theme of types of understanding (Alev, 2010; Beck & Jeffery, 2009; see also Gunel et al., 2009; Hand, Wallace, et al., 2004; Knaggs & Schneider, 2012;

McDermott & Hand, 2013; Monte-Sano, 2010), and these same two studies addressed the limits of writing's benefits (Alev, 2010; Beck & Jeffery, 2009; see also Glogger et al., 2009). Alev (2010) found that content-area writing tasks improved students' conceptual understanding and engagement in physics but cautioned that those benefits did not carry over to students' procedural and computational skills as evidenced by students' perceptions and assessment outcomes. Although teachers and students reported that the writing-to-learn activities increased interest in physics concepts, they were reticent to embrace any activities that did not transfer to improved performance on university entrance exams that were mostly computational in nature.

Conversely, Beck and Jeffery (2009) showed that 10<sup>th</sup> and 11<sup>th</sup> grade humanities students who struggled with the understanding needed for successful analytic exposition could benefit from exploring other types of understanding, such as those needed to produce narrative, descriptive, and imaginative writing. These alternate types of understanding, the authors posited, could provide a bridge that would help students transition from the more accessible types of understanding into the more complex interpretive stances needed for analytical expository essays.

While both of these studies addressed the types of understanding needed for students to be successful, the difference between their findings was likely mitigated by the specific nature and assessment structure of the disciplines studied. The physics university entrance exam's focus upon computational understanding stood apart from the more conceptual understandings encouraged by the writing tasks, whereas the analytical

exposition required in the humanities courses was more inclusive of and perhaps dependent upon the more accessible alternate writing tasks.

*Summary of commonalities across themes.* The studies included in the content category all depicted discipline-specific foci. The research showed that preparing students for assessments through critical reasoning and inquiry-based approaches improved students' assessment results and that writing-intensive assessments more fully revealed students' understandings and informed instructional planning. These studies also indicated that content-area writing tasks offered students an entrée into the larger disciplinary conversations outside the classroom. However, the studies also indicated that benefits of content-area writing tasks should be considered in relation to the intended learning outcomes.

The categories of context, cognition, and content encapsulated many diverse themes in the area of content-area writing tasks for secondary students, but they served to organize a body of research that has continued to be what Bangert-Drowns and colleagues referred to as a “disparate literature” (p. 53). Essentially, these categories provided consideration of *how* the writing tasks were situated in the instructional setting (context), *why* the writing task encouraged students' thinking (cognition), and *what* the students were learning through writing in the content areas. To continue the efforts of the current study to make meaning from the literature as outlined in Chapter III (see Bangert-Drowns et al., 2004; Graham & Perin, 2007b; Risko, et al., 2008), the following chapter offers an interpretation of the current study. Implications for both practitioners and researchers are discussed, along with limitations and general conclusions.

## **CHAPTER V**

### **SUMMARY AND CONCLUSIONS**

The previous chapters of the current study introduced the research topic, reviewed the relevant literature, described the methodology used, and detailed the findings of the systematic review. This chapter interprets the findings according to the research questions posed in Chapter III, addresses the limitations of the research, and offers directions for future research.

#### **Summary**

In order to interpret the findings of the current study, the three original queries regarding content-area writing should be revisited:

1. What are the prevalent themes in current research on writing tasks in content-area instruction?
2. In what ways does the incorporation of writing tasks into content-area instruction benefit secondary students' content-area learning and knowledge acquisition?
3. According to the research identified in a systematic literature review, what are specific research-based strategies for teachers to use in the effective integration of writing tasks into their instruction?

Each of the following sections addresses an individual question and offers a succinct response to it in light of the current study's findings.



## Major Themes in Research on Writing in Content-Area Instruction (2000-2013)

For the 37 studies that met the quality criteria, the three main categories of context, cognition, and content served to organize a discussion of the prevalent themes in current research on writing tasks in content-area classrooms (see Table 4 in Chapter IV of the current study). What follows is a discussion of each category's findings framed within other previous research and current educational legislation.

**Context.** First, the studies included in the context category, which represented 48.6% ( $n=18$ ) of all studies, were unified by their focus on the instructional setting in which the content-area writing tasks were assigned. The following themes were included in this category: (a) the models for prewriting, (b) the instructional delivery of the assignment, (c) the types of writing tasks, (d) the impact of planning and revising strategies, and (e) the frequency of writing tasks. However, this discussion will focus upon the most prevalent theme—models of prewriting.

Not only was models and templates for prewriting the most studied topic within this category ( $n = 12$ ), many benefits were documented. This is a key difference from the findings of Hebert, Gillespie and Graham's recent meta-analysis (2013), in which the authors did not find a sufficient number of studies on prewriting to make any comparisons or generalizations. The activities highlighted by their work were either process writing *during* a learning activity (e.g., note taking) or a writing-to-learn experience (e.g., summary writing) which also occurred *during* or *after* a learning activity. This difference between findings may be a result of methodology, since the current systematic literature review included mixed methods and qualitative research.

When one considers these findings in concert with Herbert and colleagues, it is clear that research is examining writing in the content areas at all points within the learning cycle and that the current research base provides teachers with strategies on incorporating writing throughout their instructional sequences. This difference in findings also highlights the benefit of using complementary methodologies to review the literature.

Additionally, it should be noted that studies on the Science Writing Heuristic (SWH) represented 66.7% ( $n=8$  out of a total of 12) of the pre-writing strategies being studied. The SWH, an inquiry-based approach to writing laboratory reports, may be receiving so much consideration due to an increased interest in disciplinary literacy. The SWH offers science students an alignment to the disciplinary literacy approach, as discussed in Chapters II and IV of the current study, in which students engage in the type of writing that professionals in the field would produce (Shanahan & Shanahan, 2008). Strategies such as the SWH are particularly relevant during the introduction of the CCSS, which are emphasizing a greater focus on reading and writing texts in the genres of science and technical subjects. These relatively new national standards offer a separate strand of literacy standards for teachers of English language arts, history and social studies, and technical subjects to encourage those teachers to use their “content-area expertise to help students meet the particular challenges...in their respective fields” (NGA Center & CCSSO, 2010, English Language Arts Standards section, para. 5).

**Cognition.** Second, the studies in the cognition category included research that examined ways in which students’ thinking processes were both revealed and amplified by writing tasks. One such example is journaling, which elicits reflections upon strategy

use. Themes in the cognition category included metacognition, assessing metacognition through journals, and writing's enhancement of talking and reasoning. In contrast to the disciplinary literacy foundation of SWH, this type of writing (using literacy for the goal of enhancing students' content knowledge) is well aligned with traditional definitions of content area literacy (Bangert-Drowns et al., 2004; Herbert et al., 2013; Moje, 2008; Vacca, 2002).

The findings within the theme of metacognition illustrate a continuation and convergence from the meta-analytic work of Bangert-Drowns and colleagues (2004). When the current study's review of studies from the years of 2000-2013 are viewed alongside their meta-analysis of studies from the years 1926-1999, it is apparent that the use of writing to promote meta-cognition has remained an important focus. Most notably, in their evaluation of 48 school-based writing programs, Bangert-Drown et al. (2004) found that only two factors predicted positive effects—metacognitive prompts and increased treatment length. They concluded that writing-to-learn interventions should always aim to facilitate students' metacognition and reflection. The recent research reviewed for the current study supports the finding that metacognition can be enhanced through writing. However, the foci of the more current research have shifted somewhat to emphasize the specificity of teachers' prompts and the ways in which metacognitive strategies are facilitated and encouraged (Glogger et al., 2009; Pugalee, 2001; Wong et al., 2002). Moreover, when students gain an awareness of their own thinking (metacognition), they are able to adapt to different learning situations by applying the most situationally appropriate modes of thinking (Conner, 2007; Pugalee, 2001). For

example, Conner's (2007) research demonstrated that when students were prompted with teacher-provided bookmarks and checklists to use self-questioning in their journals that the quality of their essays improved.

**Content.** Third, the studies included in the content category represented the convergence of research that was distinctly focused on student achievement in the content-area classrooms rather than upon student engagement or patterns of thinking. Relevant themes included achievement, formative assessment, the disciplinary conversation, and the types of understanding along with writing's limitations. In other words, this category included *writing to prepare for assessments* and *writing as assessment*. Most importantly, with the inclusion of writing tasks within key nationally administered exams (e.g., the SAT and Advanced Placement exams), it is imperative that students receive instruction that is aligned to these summative assessments and mirrors the types of writing that exams now require.

As discussed in Chapter II of the current study, the prevalence of using writing to learn and assess content-area knowledge was found to be quite varied, according to a survey of teachers conducted by Kiuvara and colleagues (2009). Teachers indicated that they regularly used short answer responses, summaries of readings, and essay exams in content-area classrooms. However, these results should be interpreted in light of students' reports. When responding to questions included in the 2007 NAEP exams, a majority of students indicated that writing is used only once per week in English language arts classes and even less so in the other content-area classes of social studies, science, and mathematics (Applebee & Langer, 2009). The revision of the SAT exam to

include writing (Shaw & Kobrin, 2012) and the inclusion of writing as a major portion of Advanced Placement U. S. History exams (Monte-Sano, 2008, 2011), for instance, makes this disparity quite troublesome. Additionally, state-level exams are beginning to include more writing tasks, as highlighted by Applebee and Langer (2009) in their analysis of NAEP data.

The findings of the studies included in the content category of the current review support the use of writing tasks both as a preparation for and as a component of content-area assessments. In other words, researchers (e.g., Buxton et al., 2013; Monte-Sano, 2010) showed how students could more fully demonstrate content knowledge when assessments included a writing component, especially when instruction included a well-aligned writing component and students were prepared to demonstrate knowledge to the depth that these writing tasks require. These findings are encouraging in light of the assessment trends of broad-scale exams such as the SAT and the Advanced Placement exams. This more recent evolution of assessments to include writing-based measures largely began after the meta-analysis of Bangert-Drowns and colleagues (2004) that ended its search for studies in 1999, so the aspect of writing-based standardized assessments as evidence of students' achievement is a relatively new addition to this area of research.

### **Benefits of Incorporating Writing Tasks into Content-Area Instruction**

Research included in each category of themes revealed research-based strategies for integrating writing tasks into content-area instruction which facilitate specific aspects of learning. The benefits of the writing tasks documented in these studies concur and

add depth to the recent meta-analysis by Herbert and colleagues (2013) which evaluated how writing tasks could benefit reading comprehension and argued that writing tasks could both “assess and extend students’ knowledge of content material” (p. 112). Bangert-Drowns et al.’s (2004) conclusions, although more cautious, also supported the recommendation that writing tasks can positively impact student achievement, especially when metacognition played a key role in the task. Similar to the findings of the previous reviews, the studies included in the final corpus consistently demonstrated how secondary students’ content-area learning and knowledge acquisition benefitted from writing tasks, with results verified through multiple measures such as students’ written responses and achievement on content-area assessments.

**Context.** The studies in the context category focused on the benefits of manipulating the instructional setting in which the content-area writing tasks were assigned. The majority of the studies focused on the logistics of the assignment (such as the requirement of prewriting models and the frequency of the writing tasks), while other studies focused more on the philosophical approach of the pedagogy (such as an emphasis upon inquiry over memorization of facts).

As evidenced by students’ writing samples and content-area assessment results, these studies showed the value of planning and relevance to the success of content-area writing tasks. Planning activities, such as the Science Writing Heuristic and a historical reasoning strategy, helped students to exhibit stronger analytical skills and deeper content-area knowledge, and the logistical implementation of the content-area writing tasks mattered in terms of student achievement. Accordingly multiple researchers (e.g.,

Hand, Wallace, et al., 2004; Haugwitz et al. 2010) advised that writing tasks should be directly relevant to the desired learning outcomes. For instance, Monte-Sano and De La Paz (2012) found that students' reasoning and argumentative abilities in history were enhanced by responding to prompts that were more evidence-based queries rather than more imaginative in concept.

Additionally, writing assignments were shown to be more beneficial when assigned regularly, which is consistent with treatment effects found by Bangert and colleagues. The studies analyzed for the current review encouraged increasing the frequency of writing tasks in the content-area classrooms. Specifically, Hand, Hohenshell and colleagues (2004) found that frequently writing to an authentic audience improved students' scores on content-area assessments and summative writing tasks, and Knaggs and Schneider (2012) found similar results when students repeatedly used Vee maps to increase both process and concept learning. Unfortunately, this regularity of writing may not be happening in classrooms. When questioned through the 2007 NAEP exams, students reported that while they were writing at least a paragraph once per week in their English language arts classes, they were writing with less frequency in their other content-area classes (Applebee & Langer, 2009).

Finally, the studies in the context category overwhelmingly advocated instructional approaches that emphasize explicit instruction and inquiry, such as the Self-Regulated Strategy Development (SRSD) instructional model. An inquiry-based philosophy of the discipline and explicit strategy instruction were both shown to improve students' learning outcomes. Such models make the writing process more

explicit and scaffolded than the traditional writer’s workshop models, advocated by Atwell (1998) and Calkins (1994). However, it is important to note that the two approaches are not mutually exclusive. According to Harris and Graham (1999), SRSD is a flexible instructional model capable of guiding the explicit introduction of writing strategies within the writing workshop approach. An analogy can be drawn to reading instruction: while some students will grow as readers through exposure to literacy in a semi-structured, text-rich environment, a large subset of students will also need “organized, systematic, efficient” instruction delivered explicitly and sequentially (Moats, 2004, p. 7). For writing, many students also need more systematic and explicit instruction to master writing across genres and across content areas.

**Cognition.** Second, the studies in the cognition category analyzed how students’ thinking processes could be revealed and how strategy use could be increased through writing tasks in the content-area classroom. Similar to what Bangert-Drowns and colleagues (2004) found in their meta-analysis, the studies included in the final corpus of the current review showed that when teachers specifically prompted students to describe their cognitive pathways to understanding that student learning outcomes improved. As discussed earlier in the cognition section addressing the first research question, metacognition is particularly important for helping students to adapt their thinking strategies to different learning situations. In these studies, improving students’ awareness of strategy use was made possible through techniques such as journal entries (Glogger et al., 2009; Wong et al., 2002), descriptions of problem-solving steps (Glogger et al., 2012; Pugalee, 2001), and transcribed think-alouds (Keys, 2000). Furthermore,



the research of Cross (2009) and Rivard (2004) showed that when teachers coupled oral discussions with the planning step of content-area writing tasks, students' achievement on content-area assessments increased.

**Content.** Third, the studies included in the content category depicted research that was more distinctly focused on achievement in the separate disciplines; however, several findings could be translated to other content areas if fine-tuned to fit the unique requirements of each discipline. For instance, Keselman and colleagues (2007) showed that using critical reasoning to understand scientific issues, such as HIV and AIDS, should be combined with content-area writing tasks as a precursor to content-area assessments. This critical reasoning required to understand scientific issues could also help students make sense of controversial issues within other courses or in their daily lives. Also originating from the science discipline, Buxton et al. (2013) found that manipulating the assessments themselves to include more writing increased the amount of scientific understanding that was demonstrated by students. The act of creating more writing-intensive assessments to measure students' understanding is also readily applicable to other disciplines.

Finally, studies in this category tout the benefits of introducing students into the disciplinary conversation. Monte-Sano (2008, 2010, 2011) researched the disciplinary literacy components of history writing and sought to define what it means to write as a historian. In addition to Monte-Sano's work, the research of Lewis and Ferretti (2011) used the critical lenses of literary topoi (e.g., using single or opposing patterns of symbolism and imagery to identify the theme in a piece of literature) to increase

students' use of textual evidence in supporting their literary arguments, a core skill in the disciplinary conversations in English language arts. These studies speak directly to the "metadiscursive framework" described by Wilson (2011, p. 442) that is necessary for students to communicate within specialized disciplines.

However, just as Bangert-Drowns and colleagues (2004) found, it should be noted that a cautionary message was imparted as well: assigning writing just for the sake of including writing does not make learning happen. Alev (2010) and found that the type of learning (conceptual versus procedural) had to be aligned with the intended assessment, and Beck and Jeffery (2009) similarly found that the genre of writing should be well-aligned to students' learning. The benefits of content-area writing tasks are more powerful when the tasks are properly aligned to the intended learning outcome.

### **Strategies for Integrating Writing Tasks into Content-Area Instruction**

Being an applied field, educational research must serve dual purposes. One purpose, according to the National Research Council (NRC, 2002) is to advance findings within the rigorous principles of scientific research. However, another purpose orients the work of educational researchers. If research is to impact the daily classroom practice of teachers, then it must balance the demands of research protocols with an "action orientation" (NRC, 2002, p. 83). In this section, the relevance of the current study's findings is discussed as it relates to practitioners, and the applicable findings are presented in a clearly accessible manner for easy reference.

The action orientation of content area literacy particularly relevant because for some secondary teachers, integrating content-area writing tasks presents a daunting

challenge. According to O'Brien, Stewart, and Moje (1995), the traditional compartmentalization of the secondary-school environment encourages the “competing pedagogy” belief (p. 449) that content curriculum leaves no room for writing tasks. The final corpus of 37 articles provided many practical suggestions for meeting this challenge and endeavoring to integrate writing tasks into secondary-level classroom instruction in the four content areas of English language arts, social studies, science, and mathematics. These key suggestions are grouped by the categories of context, cognition, and content and are delineated by content areas in Table 8.

Many of the implications listed in Table 8 are linked to more than one content area. However, it should be noted that these implications are listed only according to their appearance in the final corpus of articles. As discussed in the previous section of this chapter, extrapolating these content-specific findings to other contents is possible, since many of these implications could be translated to other content areas if fine-tuned to fit the unique requirements of each discipline. For instance, “journaling” is found in several of the rows. The frequent appearance of “journaling” in Table 8 shows this strategy’s multi-disciplinary effectiveness in content areas such as English language arts, mathematics, and science. The ways in which journaling was shown to guide and reveal thinking processes in these three content areas could easily be modified for use in social studies classrooms.

**Table 8.** Practical implications.

<b>Content Area</b>	<b>Context</b>	<b>Cognition</b>	<b>Content</b>
English language arts	<ul style="list-style-type: none"> <li>• Self-Regulated Strategy Development</li> <li>• Varying the types of tasks</li> <li>• Planning vs. revision</li> </ul>	<ul style="list-style-type: none"> <li>• Journaling</li> </ul>	
Social studies	<ul style="list-style-type: none"> <li>• Historical reasoning strategy</li> <li>• Self-Regulated Strategy Development</li> <li>• Varying the types of tasks</li> </ul>		<ul style="list-style-type: none"> <li>• Preparing for assessment with inquiry</li> <li>• Using assessment formatively</li> <li>• Engaging in the discipline</li> </ul>
Science	<ul style="list-style-type: none"> <li>• Science Writing Heuristic</li> <li>• Vee maps</li> <li>• Cognitive-based strategy instruction</li> <li>• Inquiry-based philosophy</li> <li>• Varying the types of tasks</li> <li>• Increasing frequency of writing tasks</li> </ul>	<ul style="list-style-type: none"> <li>• Specific metacognitive prompting</li> <li>• Science Writing Heuristic</li> <li>• Varying the audience</li> <li>• Journaling</li> <li>• Talking with writing</li> </ul>	<ul style="list-style-type: none"> <li>• Real-life issues</li> <li>• Writing as assessment</li> <li>• Using assessment formatively</li> <li>• Engaging in the discipline</li> <li>• Increasing conceptual understanding</li> </ul>
Mathematics		<ul style="list-style-type: none"> <li>• Specific metacognitive prompting</li> <li>• Journaling</li> <li>• Talking with writing</li> </ul>	
Cross-curricular (psychology, humanities)		<ul style="list-style-type: none"> <li>• Specific metacognitive prompting</li> <li>• Journaling</li> </ul>	<ul style="list-style-type: none"> <li>• Bridging to analytical writing with more accessible genres</li> </ul>

What is not clearly represented in Table 8 is the preponderance of studies for each implication. It should be noted that three of the implications listed in the table, the strategy of journaling, the SRSD instructional model, and the SWH, were the subject of multiple studies; thus, these implications are strongly supported by high-quality empirical studies and can be confidently recommended for classroom implementation. Furthermore, these implications show promise across domains and types of learners,

which indicates an effectiveness for deeper-level learning and critical thinking instead of mere surface-level change. This is notable because the teaching of critical thinking has proved to be exceptionally challenging (Willingham, 2007). Each of these implications and their related key points are discussed in the following paragraphs.

Journaling, the strategy discussed in the previous paragraph, appeared in the final corpus five times (13.5%) across domains. In English language arts classrooms, for instance, Wong and colleagues (2002) found that journaling for specific lines of thought (e.g., theme and character) improved students' performance when tested on a complex novel. In mathematics and science classrooms, metacognitive journaling about the steps required to complete a process was shown to make such processes more accessible to students (Glogger et al., 2012).

Similarly, there were six studies focused on the SRSD instructional model, representing 16.2% of the final corpus. SRSD, an instructional model that advocates explicit strategy instruction leading to students' independent application of that strategy (Graham and Perin, 2007c), was supported in the research collected for the current systematic review. Although SRSD has traditionally been applied to reading and writing classrooms, as shown in the research of Lewis & Ferretti (2011), more recently, other researchers have found it to be effective in social studies classrooms as well (e.g., De La Paz & Felton, 2010; De La Paz et al., 2012; Reynolds & Perin, 2009). Additionally, SRSD has found to be effective with both learning disabled and regular education students (Berninger, Nielsen, et al., 2008; Berninger, Vaughan, et al., 2002; Berninger, Winn, et al., 2008; Graham & Perin, 2007c; Harris & Graham, 1999).

Another strategy, the SWH, was the focus of eight studies, and thus represented 21.6% of the final corpus of studies. While specific to science, the studies showed that the SWH improved students' learning in multiple areas: (a) use of metacognitive strategies (Grimberg & Hand, 2009; Keys, 2000), (b) abilities to construct arguments (Choi et al., 2010), (c) writing of summarization tasks (Hohenshall & Hand, 2006; Nam et al., 2011), and (d) performance on content-area assessments (Akkus et al., 2007; Hand, Wallace, et al., 2004; Kingir et al., 2012). Therefore, an instructional decision to use the SWH to guide laboratory experiments and report writing would be supported by quality, empirical research.

### **Limitations**

The systematic literature review methodology employed by this study presents several distinct limitations (Slocum, Detrich, & Spencer, 2012). First, the current study was limited by the designs of the chosen databases. The limitations that characterize the ERIC (EBSCO), PsycINFO 1872-current (ProQuest), and Web of Science (ISI) databases inherently limited the current study. While the effort to minimize these limitations was made using Scopus, a bibliographic database, the designs of the other four databases still created an underlying limitation.

Second, the quality of the included studies also presented a limitation. This limitation was reasonably diminished by the publication selection criterion of appearing in peer-reviewed journals. Additionally, while the MQI provided a thorough method for assessing the quality of the research (see Table 1 in Chapter III of the current study), this evaluation of each study was solely based upon what was clearly reported in the

published article. In reality, a study may have included more of the criteria than were coded for it—perhaps all seven of the required criteria, but no inferences were made to increase the number of criteria met by a study. More importantly, the interrater reliability in using the seven indicators ensured the quality of the included “score 3” studies at an acceptable percentage level to help mitigate this limitation.

Third, the current study only focused on the four major content areas of English language arts, social studies, science, and mathematics. Since the location and methodology of the studies were not limited by the selection criteria used during the screening process, the researcher chose to restrict the search to these four core academic content areas for two reasons. First, while other areas such as music, art, foreign language, and physical education are beginning to accumulate in the research, preliminary searches did not show those areas to exact enough of a presence to be included in the key search terms. Second, limiting the search to the four content areas is reflective of the current directions of research (e.g., Donahue, 2003; Freedman & Carver, 2007; NGA Center & CCSSO, 2010).

Finally, the results, although quantified where appropriate, were not defined statistically as the effect sizes employed by the meta-analytic methodology would be. Since the intent of the current study was to review the research on writing tasks in content-area classrooms through a broader methodological lens, the findings of the included studies were not reported similarly and thus should not have been statistically combined.

## **Recommendations and Directions for Future Research**

Hallmarks of educational research include the benefits of sustained inquiry and accumulated knowledge (NRC, 2002). So that the current study may serve as a reliable springboard for further questions, suggested recommendations for quality research in content-area writing and directions for future research endeavors are outlined in this section.

### **Recommendations for Quality Research in Content-Area Writing**

As was described in Chapter III and Chapter IV of the current review, all of the studies were analyzed according to seven quality indicators of the MQI (see Table 1 in Chapter III of the current study). These quality indicators addressed the theoretical and research base of the study, the clarity, reliability, and validity of the study, and the consistency and appropriateness of the study's findings. While each of the 37 studies included in the final corpus met all seven of the quality indicators, the following trends of research design should be recognized for their effectiveness and thoroughness: (a) inclusion of teacher-related data to augment student-based information, (b) elaboration of research with additional configurations, and (c) differentiated groups and results based upon levels of students. By highlighting these examples of methodological rigor, other researchers can build upon such practices.

Two studies enriched the presentation of the student-based data that were collected by situating this data in a framework of teacher-based data. Akkus and colleagues (2007) conducted their research in two waves. They qualitatively evaluated the quality and fidelity of the teachers' implementation of the treatment to provide a rich



backdrop for their quantitative findings, a quantitative analysis of students' test scores. This allowed for a more nuanced interpretation of students' learning outcomes. Similarly, Buxton et al. (2013) framed the quantitative student data with teacher interview data to show how the teachers were using the results of writing-based assessments to more accurately instruct in the areas of inquiry, content, and academic language. Thus Buxton and colleagues made evident the link between students' assessment performance and teachers' instructional planning.

Other researchers chose to enrich the presentation of their data with differently configured student-based results. Several studies (Conner, 2007; Klein & Rose, 2010; Monte-Sano, 2008, 2011) implemented case studies drawn from the larger participant groups as a way of supporting and specifying their core research results. The broader-scale measures of assessments and rubric-scored writing samples were then clarified through deeper analyses of interviews, observations, and writing sample excerpts. Two groups of researchers (Glogger et al., 2012; McDermott & Hand, 2013) chose to enrich the strength of their results by replicating their work with a new group of participants. In their work studying the correlations between the strategy use reported in students' journals and test performance, Glogger and colleagues (2012) studied the same type of data with both 9<sup>th</sup> grade mathematics students and then again with 9<sup>th</sup> grade biology students to examine the influence of specific content knowledge. McDermott and Hand (2013) chose a similar approach when they reported the results of explicit instruction's effect on students' multimodal writing and conceptual understanding. With the exception of one assessment, they enacted the same research protocol with two separate

groups of 10<sup>th</sup>, 11<sup>th</sup>, and 12<sup>th</sup> grade chemistry students to further validate their findings on embeddedness in multimodal writing. In total, such efforts strengthened the reliability and generalizability of the results.

One final recommendation for quality research in content-area writing is that of differentiating both participant groups and results based upon academic levels of students. This recommendation seems to answer the call of teacher-educators such as Tomlinson (1999), who advocate the adjustment of instructional approaches to meet the varied needs of different learners. The researchers who differentiated their participant groups and their results did not all use the same type of data source for leveling. Instead, diverse sub-groups of students were represented through the different types of leveling data utilized by the studies: low and high achievement levels (Grimberg & Hand, 2009; Rivard, 2004), reading diagnostic tests (Hand, Wallace, et al., 2004), cognitive abilities tests (Haugwitz, 2010), and previous grades in the content area being studied (Hand, Hohenshell, et al., 2004; Hohenshell & Hand, 2006). These careful examinations of sub-types of learners allowed researcher to consider potential interaction of learner characteristics and the intervention.

One disappointing discovery during the quality coding step was the duplication of research without direct citation of the related study. A study by Kingir, Geban, and Gunel (2013) was found to be of high quality but was also found to be too similar to an earlier study by the same group of researchers (Kingir, Geban, & Gunel, 2012) using mainly the same data. The study from 2013, while clearing both the title/abstract and full-text screenings and passing the quality coding, was moved back into the duplicate

count of 690. The difference was that the 2013 study included semi-structured interviews and did not address the achievement levels of the previous semester's grades. The researcher chose to eliminate the 2013 study. The 2012 study was viewed to be a stronger study since it was officially published first and since it controlled for previous levels of achievement, thus carrying a more strongly perceived statistical weight.

Overall, however, the 37 studies were found to exhibit high-quality research. The unique features that some of the studies displayed—teacher-related data, additional configurations, and differentiation—only served to strengthen the final corpus of studies.

### **Directions for Future Research**

The findings of the current study serve to update the research of Bangert-Drowns et al. (2004) through a more methodologically inclusive lens. Rather than confining the literature search to quantitative studies with the goal of meta-analysis, the current study sought to identify of the relevant quantitative, qualitative, and mixed-method research on content-area writing tasks that was published in the specified date range. However, this broader search revealed a key direction for future research. The larger percentage of studies in the area of science included in the final corpus (54.1%,  $n=20$ ) may be a product of the quality coding step of the systematic review protocol. Since scientifically structured research is an innate component of that discipline and is more unfamiliar to the other three content areas, the reporting of research fulfilled the quality criteria (see Table 1 in Chapter III of the current study) perhaps more naturally and statistically more consistently. The larger representation of studies in the area of science may also be an indication that more research has been conducted on content-area writing tasks in the

science classroom than has been conducted in the other three content areas. The preponderance of studies in science classes, then, suggests that a narrowed focus, perhaps using the methodology of meta-analysis, on the topic of content-area writing tasks in science classes is merited. Conversely, a related recommendation is that the areas of English language arts, social studies, and mathematics should receive additional attention from educational researchers in the form of high-quality, empirical studies.

The current study's focus on the three research questions discussed in the previous sections prevented the researcher from following other related paths; however, two related areas offer future directions for research: the writing skills and language development in content-area classrooms and the benefit of the reading-writing connection in content-area classrooms. First, since the selection criterion of topic included studies that addressed writing tasks in secondary content-area instruction, any research on the development of general writing or language acquisition skills was excluded during the screening process. Only those studies that addressed the impact of writing tasks upon the attainment of content-area knowledge were selected as matching the topic criterion.

Second, viewing reading and writing as connected processes could enable the redefinition and expansion of content-area literacy through terminologies such as *disciplinary literacy* and *adolescent literacy*. Of interest is how all four components of literacy—reading, writing, listening, and speaking—could benefit students' 21<sup>st</sup> century work in and across every content area they pursue. Moreover, the final corpus of studies focused on traditional literacies, such as written responses and content-area assessments.

The current view of adolescent literacy is much more expansive (International Reading Association, 2012; National Council of Teachers of English, 2006) and is inclusive of interactions with both traditional and multimodal texts across the discipline areas. As the views of texts expand to include more digital texts and visually rich texts, teaching practices should move to reflect that shift. Therefore, future research should also explore the integration of technological and visual aspects of literacy into writing within the content-area classrooms.

### **Conclusion**

The current study contributes both breadth and specificity to the existing research on writing tasks in content-area classrooms (e.g., Graham & Perin, 2007a, 2007b, 2007c; Bangert-Drowns et al., 2004). Employing the systematic literature review's broad methodological scope captured the varied types of research being conducted in the field of content-area writing instruction. Unlike the effect-size query in a meta-analysis, the findings of quantitative, qualitative, and mixed methods studies were thematically analyzed and then synthesized into the enlightening categories of context, cognition, and content. This act of synthesis formed a foundation for drawing conclusions about the current status of the field (Bangert-Drowns et al., 2004; Graham & Perin, 2007b; Risko et al., 2008).

Second, the specificity of the current study provided a focused emphasis on writing tasks in content-area classrooms. The impact of incorporating writing tasks into the secondary content-area classrooms was examined in light of the logistics of the

instructional setting (context), the encouragement of thinking (metacognition), and the attainment of content-area knowledge (context).

Both contributions served to answer the research questions of the study. While there are many prevalent themes in current research on writing tasks in content-area instruction, topics such as pre-writing, explicit instruction, metacognition, and student achievement dominated the final corpus of reviewed studies. Furthermore, these studies demonstrated that the incorporation of writing tasks into content-area instruction benefitted secondary students' content-area learning and knowledge acquisition, as evidenced by students' writing and content-area achievement. Finally, the research identified by this systematic literature review revealed key implications for teachers to consider when integrating writing tasks into their content-area instruction, such as journaling with metacognitive prompting, the SRSD explicit instructional model, and the SWH template for science-lab reporting.

In total, teachers and researchers can, with a great measure of certainty, draw the following conclusion: when thoughtfully planned within an instructional setting that encourages cognitive acts, content-area writing tasks positively impact a variety of students' learning outcomes, across both disciplines and different types of learners.

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## APPENDIX

### INCLUSIONARY STUDIES

Study	Participants and Setting Population, Number, Location	Research Method(s) and Data Source(s)	Data Analysis	Research Focus	Study Findings
Akkus, R., Gunel, M., & Hand, B. (2007)	Group 1: <i>N</i> = 7 science teachers, grades 7-11, classes divided into 11 control and 12 treatment Group 2: <i>N</i> =592 students, 270 control and 322 treatment Location: United States	MIXED Group 1: quality of teacher implementation evaluated qualitatively using video-taped lessons and observations Group 2: student achievement evaluated quantitatively using student test scores	Group 1: interpretive case study Group 2: ANOVA and ANCOVA	Traditional instruction in science classrooms vs. an inquiry approach using the Science Writing Heuristic (SWH)	The quality of teachers' implementation of the SWH impacts student achievement and high-quality implementation of the SWH helps to close the achievement gap.
Alev, N. (2010)	<i>N</i> =2 physics teachers, 42 physics students Location: Turkey	MIXED Case study including questionnaires, observational field notes, student responses, and semi-structured interviews	Likert-scale questionnaires analyzed for mean; interviews, notes, and responses coded for themes	Value of reading and writing in science and improvements in conceptual understanding	Reading and writing activities improved students' conceptual understanding and engagement but did not improve procedural or computational skills.

<b>Study</b>	<b>Participants and Setting</b> Population, Number, Location	<b>Research Method(s) and Data Source(s)</b>	<b>Data Analysis</b>	<b>Research Focus</b>	<b>Study Findings</b>
Beck, S. W. & Jeffery, J. V. (2009)	<i>N</i> =7 10th grade students and 4 11th grade students, Humanities (history/literature combination) course Location: United States	QUALITATIVE Retrospective, structured interviews along with excerpts of students' writing	Descriptive (a priori) and interpretive coding of interviews and excerpts of students' writing	Students' ability to subjectively identify themes for analytical writing and how alternate genres could help this thinking	When writing analytical expository essays, students found interpretive stances difficult. Other genres may help bridge the way to academic genres.
Buxton et al. (2013)	<i>N</i> = 11 science teachers (1 4th grade, 1 5th grade, 2 6th grade, 3 7th grade, and 4 8th grade) and 757 4th-8th grade students Location: United States	MIXED Students' assessment results analyzed quantitatively and teachers' interviews and written responses evaluated qualitatively	Pre- and posttest results equated and then analyzed for correlations; teachers' responses grouped by similarities	The use of writing-intensive educative assessments to increase instructional emphasis upon science understandings	The educative assessments enabled teachers to more accurately instruct in the areas of inquiry, content, and academic language.
Choi, A., Notebaert, A., Diaz, J., & Hand, B. (2010)	<i>N</i> =107 students (13 Year 5, 38 Year 7, and 56 Year 10) (296 total science writing samples) Location: United States	QUANTITATIVE Student writing samples	Samples scored for Total Argument and Holistic Argument and analyzed with multiple stepwise linear regression	The use of the Science Writing Heuristic (SWH) to assist students' development of arguments	The SWH framework helps students to construct evidence-based claims.

Study	Participants and Setting Population, Number, Location	Research Method(s) and Data Source(s)	Data Analysis	Research Focus	Study Findings
Christenson, N., Rundgren, S. C., & Hoglund, H. (2012)	N=80 upper secondary students (40 science majors and 40 social science majors) Location: Sweden	QUANTITATIVE Student writing samples	Samples scored for 18 possible sentence-level codes and analyzed for distribution across a sociocultural framework (SEE-SEP) and knowledge, value, and personal experience (KVP) categories	How the SEE-SEP framework intersects with KVP to show students' use of argumentation and evidence in writing	Using socioscientific issues (SSIs) can enhance students' multidisciplinary engagement in science.
Conner, L. N. (2007)	N=16 high-school biology students; 3 were featured as case studies Location: New Zealand	QUALITATIVE Student interviews, journal entries, essays, and classroom observations; case studies	Pre- and post interviews, class work, journals, and essays evaluated for awareness/use of strategies; case studies revealed how the students used the strategies	How teachers can scaffold students' metacognitive strategies and students' thinking as shown in writing	When teachers prompt metacognitive thinking about strategies, students learn more effectively and produce higher-quality essays.
Cross, D. I. (2009)	N=211 9th grade math students and 5 teachers Location: United States	MIXED Assessments for 4 groups (3 experimental and 1 control) analyzed quantitatively; transcripts of classroom activities, discussions, and students' papers analyzed qualitatively	Pre-and posttests analyzed via ANCOVA; bi-weekly observation transcripts and students' writing analyzed to clarify quantitative results in more detail	How argumentation discourse and writing can improve students' achievement in mathematics	The argumentation-writing and writing-only groups showed the highest level of achievement (over the argumentation-only and control groups).

<b>Study</b>	<b>Participants and Setting</b> Population, Number, Location	<b>Research Method(s) and Data Source(s)</b>	<b>Data Analysis</b>	<b>Research Focus</b>	<b>Study Findings</b>
De La Paz, S., Ferretti, R., Wissinger, D., Yee, L., & MacArthur, C. (2012)	<i>N</i> =70 8th grade students in integrated social studies and language arts setting Location: United States	MIXED Students' essays (from two teams) analyzed quantitatively; interviews with students analyzed qualitatively	Pre- and posttest essay scores analyzed for 4 characteristics via ANOVA; interview transcripts described for historical understanding and confidence with the model	The use of a historical reasoning strategy/model to improve historical argumentative essay writing	The instruction on historical reasoning and argumentative writing skills produced more accurate and persuasive writing by students in the experimental team.
De La Paz, S. & Felton, M. K. (2010)	<i>N</i> =160 11th grade U.S. History students (4 groups, 1 control and 1 experimental at 2 schools) Location: United States	QUANTITATIVE Student writing samples	Pre- and posttest essay scores analyzed for 6 characteristics via ANOVA and ANCOVA	The use of a historical reasoning strategy/model to improve historical argumentative essay writing	The instruction on historical reasoning, argumentative writing skills, and use of evidence produced more accurate and persuasive writing by students in the experimental groups.
Glogger, I., Holzäpfel, L., Schwonke, R., Nückles, M., & Renkl, A. (2009)	<i>N</i> =44 9th grade mathematics students (2 classes) Location: Germany	QUANTITATIVE Student journal writing samples	Journal entries coded for quantity and quality of learning strategies and recorded (MANOVA and <i>t</i> -tests)	The specificity of prompts and the quantity and quality of the journal responses produced	Increased specificity of prompts elicited higher quantities of learning strategies in journal responses; however, the quality of the learning strategies leaves room for improvement.

Study	Participants and Setting Population, Number, Location	Research Method(s) and Data Source(s)	Data Analysis	Research Focus	Study Findings
Glogger, I., Schwonke, R., Holzäpfel, L., Nückles, M., & Renkl, A. (2012)	Study 1: <i>N</i> =236 9th grade mathematics students (10 classes) Study 2: <i>N</i> =144 9th grade biology students (8 classes) Location: Germany	QUANTITATIVE Assessments of prior and learned knowledge, questionnaires on motivation, and student journal writing samples	Pre- and posttest scores, questionnaire results, and journal entries coded for the quantity and quality of learning strategies recorded (hierarchical linear modeling, correlations, and ANOVA)	The relationship between the quality and quantity of learning strategies recorded by students in learning journals and learning outcomes	Strategy-based responses in learning journals affect learning outcomes with correlations shown between outcomes and the quantity and quality of strategies recorded.
Grimberg, B. I. & Hand, B. (2009)	<i>N</i> =33 7th grade Life Science students (21 high-achieving, 12 low-achieving) Location: United States	MIXED Students' lab reports analyzed qualitatively; scores analyzed quantitatively	Reports coded for reasoning operations; tests of independence/association for cognitive levels and achievement levels using chi-square analysis	The relationship of achievement levels and cognitive pathways for students using the Science Writing Heuristic (SWH) to write lab reports	Although the pathways slightly differ, both low- and high-achieving students exhibit higher-level cognitive operations when using the SWH to write lab reports.
Gunel, M., Hand, B., & McDermott, M. A. (2009)	<i>N</i> =20 9th grade and 98 10th grade biology students (4 classes) Location: United States	QUANTITATIVE Assessments and students' written responses	Pre- and posttest scores analyzed using ANOVA, ANCOVA, and MANOVA; writing tasks analyzed using stepwise linear regression	The impact of writing-to-learn tasks upon student learning and the impact of audience upon cognitive planning	Writing-to-learn tasks increase students' science understanding, especially when the designated audience requires richer explanations.

<b>Study</b>	<b>Participants and Setting</b> Population, Number, Location	<b>Research Method(s) and Data Source(s)</b>	<b>Data Analysis</b>	<b>Research Focus</b>	<b>Study Findings</b>
Hand, B., Hohenshell, L., & Prain, V. (2004)	<i>N</i> =73 10th grade biology students (4 classes) Location: United States	MIXED Baseline grades, students' written responses, and assessments analyzed quantitatively; student interviews analyzed qualitatively	Previous semester's grades, writing task scores, and posttest scores analyzed using ANCOVA; semi-structured interviews coded for patterns of students' perceptions	The effects of planning and frequency of writing-to-learn tasks upon students' learning outcomes	Planning tasks deemed useful without significant regard to timing, and writing more than once (to an authentic audience) increased students' learning outcomes.
Hand, B., Wallace, C. W., & Yang, E. (2004)	<i>N</i> =93 7th grade biology students (5 classes) Location: United States	MIXED Assessments analyzed quantitatively; student interviews analyzed qualitatively	Reading diagnostic test and science-related pre- and posttest scores analyzed using ANCOVA; semi-structured interviews transcribed and coded for emerging categories	The impact of two writing-to-learn tasks upon students' conceptual and metacognitive science understandings	Non-traditional writing-to-learn tasks improved students' conceptual knowledge and metacognition of science understanding.
Haugwitz, M., Nesbit, J. C., & Sandmann, A. (2010)	<i>N</i> =248 secondary biology students (average age: 13.88 years) divided into 77 groups Location: Germany	QUANTITATIVE Assessments, biology grades, and students' summary scores (for either essays or concept maps)	Pre- and posttest, cognitive abilities test, and summary scores analyzed using ANOVA and ANCOVA	The interaction of cognitive ability and collaboration with the type of summarization method used (essay or concept mapping)	Concept mapping, while an effective summarization method for students of all ability levels, is especially beneficial for the learning outcomes of students with lower cognitive abilities.

<b>Study</b>	<b>Participants and Setting</b> Population, Number, Location	<b>Research Method(s) and Data Source(s)</b>	<b>Data Analysis</b>	<b>Research Focus</b>	<b>Study Findings</b>
Hohenshell, L. M. & Hand, B. (2006)	<i>N</i> =91 mostly-9th grade advanced biology students (4 classes) Location: United States	MIXED Baseline grades and assessments analyzed quantitatively; surveys and student interviews analyzed qualitatively	Previous unit test grades, pre-test scores, and 2 posttest scores analyzed using ANCOVA and chi-square; open-ended surveys and semi-structured interviews coded for themes	The use of the Science Writing Heuristic (SWH) as a pre-writing activity for writing a summary report and how linking the two writing-to-learn tasks impacts student learning outcomes	Students who used the SWH instead of the traditional lab report as a precursor to a summary report exhibited greater ownership and achievement of the learning outcomes.
Hübner, S., Nückles, M., & Renkl, A. (2010)	<i>N</i> =70 secondary psychology students (mean age: 17.62) (4 groups) Location: Germany	QUANTITATIVE Assessments and students' written responses	Topic specific pre-(1) and posttest (2) scores and coded amount of evident strategy use analyzed using ANOVA	How the use of informed prompting and models impacts the learning outcomes of journal writing	Students who were given informed prompts and models for writing their learning journals exhibited higher posttest scores.
Keselman, A., Kaufman, D. R., Kramer, S., & Patel, V. L. (2007)	<i>N</i> =61 7th grade science students Location: United States	MIXED Assessments and reasoning tasks analyzed quantitatively; students' written and oral responses analyzed qualitatively	Pre- and posttest scores, and coded task responses analyzed using ANOVA, chi-square, and McNemar tests; excerpts from student's writing and transcribed oral responses qualitatively offer support for statistical findings	The impact of critical reasoning tasks and writing activities upon students' knowledge, understanding, and reasoning about real-life scientific issues	Students who engaged in both reasoning and writing activities exhibited higher learning outcomes than those students who engaged in reasoning tasks only or were part of the control group.

Study	Participants and Setting Population, Number, Location	Research Method(s) and Data Source(s)	Data Analysis	Research Focus	Study Findings
Keys, C. W. (2000)	N=16 8th grade earth science students Location: United States	QUALITATIVE Students' think-aloud recordings and written lab reports	Audiotapes of students' think-alouds transcribed and coded for categories; written lab reports were coded for scientific thought processes then holistically assessed	An examination of the thinking processes used by students writing laboratory reports when supported by the Science Writing Heuristic (SWH)	For students who engaged in mental reflection during the writing process, written laboratory reports stimulated science learning.
Kieft, M., Rijlaarsdam, G., & van den Bergh, H. (2006)	N=113 10th grade literature students (5 classes) Location: Netherlands	QUANTITATIVE Questionnaires, students' written responses and workbook activities, lesson evaluations	Questionnaires of planning and revising strategies, pre- and posttest literary interpretations, workbook activities, and lesson evaluations analyzed using correlation, interaction, and ANOVA	The effectiveness of adapting writing-to-learn tasks to writing strategies, either planning or revising, when teaching literature	Planning strategies improve literary interpretation skills in writing-to-learn tasks.



Study	Participants and Setting Population, Number, Location	Research Method(s) and Data Source(s)	Data Analysis	Research Focus	Study Findings
Kieft, M., Rijlaarsdam, G., & van den Bergh, H. (2008)	N=220 10th grade literature students (8 classes) Location: Netherlands	QUANTITATIVE Questionnaires, students' written responses, lesson evaluations	Questionnaires of planning and revising strategies, pre- and posttest literary interpretations, and lesson evaluations analyzed with descriptive statistics and regression slopes for effects of aptitude/ treatment interaction	The interaction of writing to learn about literary stories with either planning or revising writing strategies	Adapting the writing-to-learn task to the appropriate strategy increases students' learning outcomes.
Kingir, S., Geban, O., & Gunel, M. (2012)	N=122 9th grade chemistry students Location: Turkey	QUANTITATIVE Semester averages, assessments	The students' chemistry grades from the previous semester and pre- and posttest scores analyzed with ANOVA and ANCOVA	The effectiveness of using the Science Writing Heuristic (SWH) in improving student learning outcomes	Use of the SWH significantly closes the science-learning achievement gap between low- and high-achieving students.
Kingir, S., Geban, O., & Gunel, M. (2013)	This study, while clearing both the title/abstract and full-text screenings and passing the quality coding, duplicates the one above too closely and thus was moved back into the duplicate count of 690. The difference is that this study includes semi-structured interviews and does not address the achievement levels of the previous semester's grades. The researcher chose to eliminate this study since the 2012 study listed above was officially published first, and the way it controlled for levels of achievement increased its perceived statistical weight.				

<b>Study</b>	<b>Participants and Setting</b> Population, Number, Location	<b>Research Method(s) and Data Source(s)</b>	<b>Data Analysis</b>	<b>Research Focus</b>	<b>Study Findings</b>
Klein, P. D. & Rose, M. A. (2010)	N=34 5th and 6th grade science students (2 classes) with a focus on 7 students from the experimental class Location: Canada	QUANTITATIVE Multiple assessments (pre- and posttests surrounding formative assessments and ongoing treatment decisions) in a "design experiment"	Pre- and posttests for approach to writing (survey), genre knowledge (survey), and argument and explanation quality (writing samples) analyzed with MANOVA	Implementing the knowledge transformation model through argumentative and explanatory writing-to-learn tasks	Situated cognition enabled students to move from rhetorical to content problem solving when given argumentative and explanatory writing-to-learn tasks.
Knaggs, C. M. & Schneider, R. M. (2012)	N=50 9th grade biology students Location: United States	MIXED Students' Vee map responses and lab report scores analyzed quantitatively; survey responses analyzed qualitatively	Vee map and lab report scores coded using rubrics and reported through descriptive statistic bar graphs; ANOVA, and correlation; survey responses categorized and tallied	The repeated effects of using a Vee map on students' science process and concept understandings as shown through the Vee map responses, lab reports, and surveys	Repeated use of Vee maps to scaffold students' lab experiences supported increased process and concept learning as shown through the Vee map responses, lab reports, and surveys.
Lewis, W. E. & Ferretti, R. P. (2011)	N=6 10th and 11th grade English students Location: United States	QUANTITATIVE Students' written responses	Baseline, target, and non-target writing probes coded for functional and non-functional units of meaning and scored for quality then analyzed using Percentage of Non-overlapping Data (PND)	The Self-Regulated Strategy Development (SRSD) instruction in two topoi to impact the quality and evidence use in literary argumentative writing	SRSD instruction in literary topoi improves the quality of argument and the use of textual evidence in students' literary argumentative writing.

Study	Participants and Setting Population, Number, Location	Research Method(s) and Data Source(s)	Data Analysis	Research Focus	Study Findings
McDermott, M. A. & Hand, B. (2013)	Case 1: <i>N</i> =70 10th, 11th, and 12th grade chemistry students (3 classes) Case 2: <i>N</i> =95 10th, 11th, and 12th grade chemistry students (5 classes) Location: United States	QUANTITATIVE Assessments and students' written responses	Scores (for baseline science assessment and writing sample, 2 unit writing assignments and 2 unit assessments- only 1 for Case 2) analyzed on the group level using <i>t</i> -tests, ANCOVA, and effect size and on the individual level using correlations and regression analysis	The effect of embeddedness in multimodal writing upon conceptual chemistry understanding and the impact of instructional supports for multimodal writing	When students are explicitly instructed on embeddedness, students' multimodal writing and conceptual understanding improves.
Monte-Sano, C. (2008)	<i>N</i> =42 high school U.S. history students (2 classes) with 2 students used as case studies Location: United States	MIXED Students' written responses analyzed quantitatively; interviews, observations, teacher feedback, assignments, readings analyzed qualitatively	Pre- and posttest writing sample scores compared using standard deviation and mean; other data sources organized chronologically and coded for themes and trends using time-series analyses; 2 students' essays closely analyzed using rubric	The types of instruction used to support students when writing evidence-based history essays	A constructivist approach to teaching history as interpretation supports students in writing and reasoning skills for improved learning outcomes.

<b>Study</b>	<b>Participants and Setting</b> Population, Number, Location	<b>Research Method(s) and Data Source(s)</b>	<b>Data Analysis</b>	<b>Research Focus</b>	<b>Study Findings</b>
Monte-Sano, C. (2010)	<i>N</i> =56 11th grade U.S. history students (3 classes) Location: United States	QUALITATIVE Students' written responses	Students' essays analyzed and coded for historical thinking and argument structure	Defining disciplinary literacy components of history writing	Five trends of historical writing emerged: accuracy, persuasiveness, sourcing, corroboration, and contextualization of evidence.
Monte-Sano, C. (2011)	<i>N</i> =15 11th grade U.S. history students with 3 students used as case studies Location: United States	MIXED Students' written responses analyzed quantitatively; regularly assigned tasks, interviews, observations, teacher feedback, artifacts analyzed qualitatively	Pre- and posttest writing sample scores compared using standard deviation and mean; other data sources organized chronologically and coded for themes and trends using time-series analyses; 3 students' essays closely analyzed using a rubric	The discipline-specific literacy instruction of one teacher and the impact upon the students' historical reasoning and writing	When history is taught using the historical-interpretative view that emphasizes evidence use, perspective recognition, and interpretation, students' historical writing improves.
Monte-Sano, C. & De La Paz, S. (2012)	<i>N</i> =68 10th grade World History students (8 classes) and 33 11th grade U.S. history students (3 classes) Location: United States	QUANTITATIVE Students' assessments, class work, and written responses	Pretest and document work scores analyzed using ANOVA; essays scored for historical writing ability and reasoning using a rubric; all combined and analyzed with MANOVA and regression analyses	Four different writing prompts administered to determine the most effective prompt types for historical perspectives and reasoning	Writing prompts that focus on sourcing, corroboration of documents, and causation are more effective than imaginative prompts for improving students' historical writing outcomes.

<b>Study</b>	<b>Participants and Setting</b> Population, Number, Location	<b>Research Method(s) and Data Source(s)</b>	<b>Data Analysis</b>	<b>Research Focus</b>	<b>Study Findings</b>
Nam, J., Choi, A., & Hand, B. (2011)	<i>N</i> =345 8th grade science students (11 classes) Location: Korea	QUANTITATIVE Assessments and students' written responses	Science reasoning assessment, Reformed Teaching Observation Protocol (RTOP), and Summary Writing Test (SWT) scores analyzed using ANCOVA and effect size	The impact of the Science Writing Heuristic (SWH) approach upon students' content-area writing	Students who were taught using the SWH approach (in high levels of implementation) performed significantly better on summary writing tasks.
Pugalee, D. K. (2001)	<i>N</i> =20 9th grade algebra students Location: United States	QUALITATIVE Students' written responses	Students' written descriptions of processes were coded for problem-solving phases and metacognitive behaviors	The evidence of metacognitive behaviors in students' written records of problem solving	Results show that students exhibited metacognitive behaviors throughout all four problem-solving phases.
Reynolds, G. A. & Perin, D. (2009)	<i>N</i> =121 7th grade social studies students (6 classes) Location: Canada	QUANTITATIVE Assessments and students' written responses	The scores of 2 diagnostic assessments and pre- and posttests of content knowledge, along with a pretest and 3 posttests of writing summarizations, analyzed using ANCOVA and pair-wise post hoc comparisons	The use of text structure instruction (TSI) and a planning strategy (PWS) in teaching students to compose from expository text structures	The use of TSI and PWS instruction improved students' performance when writing expository text summary and positively impacted students' content-area knowledge.

Study	Participants and Setting Population, Number, Location	Research Method(s) and Data Source(s)	Data Analysis	Research Focus	Study Findings
Rivard, L. P. (2004)	N=154 8th grade science students (8 classes) Location: Canada	MIXED Assessments analyzed quantitatively; peer discussions and students' written responses analyzed qualitatively	Pre- and post-test (2) scores analyzed using repeated measures and planned comparisons/ contrasts analysis; transcribed discussions coded and explanatory writing samples scored with a rubric	The impact of achievement level upon the effectiveness of talk and writing descriptive and explanatory tasks	Low achievers demonstrated higher learning outcomes when talk preceded the measure, but high achievers benefitted more from explanatory writing.
Wong, B., Kuperis, S., Jamieson, D., Keller, L., & Cull-Hewitt, R. (2002)	N=48 12th grade English students (3 classes) Location: Canada	MIXED Assessments, student self-rating form analyzed quantitatively; student interviews analyzed qualitatively	Two posttests (character and theme) analyzed using ANOVA; ratings from responses analyzed descriptively; interview responses analyzed for themes	The effects of two types of guided journal writing upon students' understanding and appreciation of a complex novel	Students who wrote character- or thematic-based journal entries scored significantly better on posttests over a complex novel.