A Third Grade Teacher’s Experience Using Science Notebooks to Teach Expository Writing

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A Third Grade Teacher’s Experience Using Science Notebooks
to Teach Expository Writing

by

Pamela Deiboldt

A thesis submitted to the Department of Education and Human Development at
The College at Brockport, State University of New York in partial fulfillment of the
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Chapter 1: Introduction

Statement of the Problem

As I stood at the front of my classroom on that Wednesday afternoon in October, I took a deep breath in an attempt to relieve my anxiety. It had been another busy and productive day in room H1. My third grade students were scattered around the room engaged in multiplication activities. While one group of students was seated at the computers reviewing how to use arrays to solve multiplication sentences, another group was huddled in the middle of the room practicing repeated addition. To my left students, assembled in pairs, were grouping counters to solve multiplication problems posed in their textbooks. Everyone was absorbed in work. I was pleased that my students were fully engaged in problem solving activities, but I could still feel a knot in the pit of my stomach.

As I began to slowly turn to look at the clock, I heard a voice ask, “Miss Deiboldt, when are we having science?” This was not the first time Ethan (all names are pseudonyms) had asked this question. A budding oceanographer, Ethan routinely came to school ready to present his recent inquiries about sharks. In fact, he had recently inspired the whole class to research and write about the similarities and differences between sharks and dolphins.

My eyes quickly darted to the clock, the bane of my existence: 2:55p.m.! Only fifteen minutes until my students would gather their belongings and head home. Ethan’s eyebrows were raised, showing his delight in the thought of assembling models of rodent bones. I paused, conscious that what I was about to say would crush his excitement.
“I’m so sorry to disappoint you, Ethan. We only have a short time until we go home. I promise we will investigate the bones tomorrow!” His eyes immediately revealed his dissatisfaction with my response. “Aww!” I heard Alan groan. I knew he had overheard my apology. “We’re not doing science today, Miss Deiboldt? Why not?” Sarah piped in. At this point, a majority of my students had stopped what they were doing and waited for my explanation. To negotiate, I told them I would let them begin to examine the bones after they had finished their morning work the next day. Ethan crossed his arms and scowled at me, which intensified my guilt.

This was not the first time I expressed my regret to my students for not having enough time for science. I did not like the idea of skipping science any more than Ethan. Wednesday and Thursday were the only two days of the school week I scheduled science. On Monday and Tuesday, my students traveled next door to Mrs. Miller’s classroom for social studies. While my students were at social studies, I taught science to Mrs. McNair’s students. Due to this tight schedule, I was fighting to maximize every minute of the school day.

With the adoption of the new Common Core State Standards (CCSS) came the arrival of new reading and math programs. My elementary school’s new reading series, Treasures (Macmillian/McGraw-Hill, 2011) involved a balanced literacy approach, which meant that my students and I spent the entire first half of every day doing mini-lessons, guided reading, self-selected reading, read-alouds, writing, student-teacher conferences and/or word work. At noon, my students left for lunch as readers and writers and returned thirty minutes later as mathematicians. I soon discovered that the 55-minutes that I had allotted for math was not nearly enough time to address everything that
needed to be accomplished in math, which meant extending math into the scheduled
science block. Consequently, I would put science on the back burner. Undoubtedly, this
was upsetting for my curious scientists. I recognized I was doing a disservice to all my
students by failing to provide them with meaningful experiences to learn about the world
in which they live, and I knew I needed to find a solution to this problem and quickly.

**Significance of the Problem**

In 2010, educational reform swept the nation with the release of the Common
Core State Standards in English language arts and mathematics
(http://www.corestandards.org/). Three years later, forty-five states have adopted the
standards, including New York in January 2011 (http://www.corestandards.org/). One
purpose behind the Common Core State Standards is to ensure all students are college
and career ready in literacy and mathematics by the time they complete grade twelve
(http://www.corestandards.org/). In a 2006 study by the OECD’s Programme for
International Study Assessment (PISA), it was discovered that out of thirty industrialized
countries, the United States ranked twenty-fifth in math, fifteenth in reading, and twenty-
first in science achievement (http://www.corestandards.org/). American students are
underperforming compared to other nations creating a significant performance gap.
Because the Common Core standards are aligned to college and career expectancies and
the learning standards of high performing countries, they are true-to-life yet very rigorous
(http://www.corestandards.org/). In other words, the proponents of CCSS believe that if
students in the U.S. are competent in the areas of literacy and mathematics, our nation
will be in a better position to compete in the global economy (http://www.corestandards.org/).

According to the CCSS, a student must attain mastery level of the standards at the end of grade twelve by demonstrating independence, building strong content knowledge, responding to the varying demands of audience, task, purpose, and discipline, comprehending as well as critiquing, valuing evidence, using technology and digital media strategically and capably, and coming to understand other perspectives and cultures (http://www.corestandards.org/).

My elementary school adopted new curriculum programs in literacy—Treasures (Macmillian/McGraw-Hill, 2011) and mathematics—enVisionMATH (Foresman & Wesley, 2011) that were designed to align to the Common Core Standards. Although I believe the Treasures curriculum is suitable for my students who are reading on grade level, I often supplement with reading material because the anthology texts and leveled readers are much too difficult for my students who struggle with reading. Last year I piloted the Treasures program and I am currently supporting my eight, third grade colleagues as they learn to navigate the lessons and activities, texts, and assessments that are part of the program.

While my colleagues and I work to effectively utilize Treasures, we are also learning to successfully incorporate the problem-based interactive learning series, enVisionMATH (Foresman & Wesley, 2011), which is designed to be used to encourage students to take multiple paths to the same learning outcome, and emphasize a deep conceptual understanding of content material. In our most recent unit on fractions, for example, my students learned various ways to find fractional parts of a set. In addition to
problem solving, my mathematicians were also expected to explain their thinking process through writing, a process, which is supposed to help them develop a deeper understanding of the content. This form of writing is addressed by writing standard two for third grade.

Common Core State Standard two for third grade writing states students will write informative/explanatory texts to examine a topic and convey ideas and information clearly (http://www.corestandards.org/). As part of this learning standard, students must be able to a) introduce a topic and a group of related information together; include illustrations when useful to aiding comprehension, b) develop a topic with facts, definitions, and details, c) use linking words and phrases to connect ideas within categories of information, and d) provide a concluding statement or section (http://www.corestandards.org/).

Despite the advanced literacy and math skills our third grade students must demonstrate, my colleagues and I are dealing with the reality that many of our students are performing well below the Common Core State Standards for our grade level. Upon analysis of assessment data I collected during the current school year, I have found that four of my third graders are not yet reading at grade level. This is a major concern because my students must meet reading and writing expectations for third grade in order to succeed in math.

My colleagues and I are extending instructional time in literacy and math so that we can incorporate all the components of Treasures and enVisionMATH. We hope that the new curriculum and latest pedagogical practices as well as the extended amount of time that we are devoting to instruction and practice will have a positive impact on our
students’ academic achievement. Consequently, we are sacrificing time for science and social studies. I am interested in examining ways to maximize instructional time so that there is time in the school day for these subject areas, specifically science. My study will provide me with a tactic for combining the Common Core State Standards, specifically standard two, writing to explain and inform, and my desire for my students to learn about science.

The authors of the Common Core State Standards emphasize an interdisciplinary approach to learning (http://www.corestandards.org/). Students must demonstrate proficiency in literacy across all content areas so that they can learn the necessary skills to be successful in life beyond school (http://www.corestandards.org/). Therefore, it only makes sense that the learning experiences I create for students have real world application, which is why I am attempting to integrate opportunities for my students to combine the genre of expository writing and their interests in science. Expository writing includes various forms such as explanatory, procedural, narrative, descriptive, and persuasive (Butler & Nesbit, 2008). I would like to develop experiences through which my students can share their scientific discoveries with others through written communication, specifically expository writing, in ways similar to how professional scientists use expository writing.

Writing in science can significantly impact multiple dimensions of academic development (Gilbert & Kotelman, 2005). Calkins and her colleagues express that writing is a powerful thinking tool (Calkins, Ehrenworth, & Lehman, 2012). When students write in science, they are more likely to construct deeper conceptual understanding of the content material (Gilbert & Kotelman, 2005). First and second
grade teachers in Tuscan, Arizona recognized a higher level of active engagement when their students had the opportunity to record observations and questions during scientific investigations (Gilbert & Kotelman, 2005). Through writing, the students were able to increase the depth of their thinking (Gilbert & Kotelman, 2005).

In addition to enhancing engagement and thinking processes, Routman (2000) claims that writing encourages individuals to become explicit communicators. The principal of the Tuscan elementary school noticed a major improvement in the students’ oral language skills as result of the integration of writing and science (Gilbert & Kotelman, 2005). As the enthusiastic students engaged in discussions related to their investigations, they were acquiring new vocabulary (Gilbert & Kotelman, 2005).

There is also evidence that suggests incorporating writing into science activities can greatly increase student achievement on standardized tests (Butler & Nesbit, 2008). Fourth graders in El Centro, California doubled their test scores in reading, math, and science after participating in an integrated writing and science program (Butler & Nesbit, 2008). Similarly, sixth graders in the same school district nearly quadrupled their scores after four years of integrated instruction (Butler & Nesbit, 2008).

I strongly believe that science instruction and exploration must not be neglected! Calkins et al., (2012), Gilbert and Kotelman (2005), Routman (2000), and Butler and Nesbit (2008) highlight the interconnectedness of science and other content areas, particularly writing. This leads me to question how I might go about tailoring my science instruction to align to the third grade curriculum goals defined by the Common Core State Standards (http://www.corestandards.org/). My colleagues and I are realizing that we must adapt our teaching to meet the new requirements and expectations of the CCSS,
and we are seeking methods that are both authentic and developmentally appropriate for our wide range of diverse learners.

**Purpose of the Study**

Shortly after that day in October, when I had yet again, abandoned science, the light bulb went on. I discovered how I could continue to use the literacy and math programs my school had adopted to align to the Common Core State Standards without omitting science. It happened when I was in my graduate course, Teaching Childhood Science. The topic that particular evening was how to use science notebooks in the classroom. My professor, Mrs. Webster, asked my peers and me to engage in an investigation while using our notebooks to record our predictions, observations, and findings. By the end of the investigation, my notebook page revealed my evidence of thinking before, during, and after the investigation.

“Science notebooks are a great way of integrating writing and science!” I said excitedly to my colleague, Marsha, the next morning. She gave me a blank stare. After a while she said, “I just don’t think there is enough time for that, I already have very little time for science. That seems like more work. I think I’m just going to stick with the worksheets that correspond with the investigations.”

Despite Marsha’s reluctance, I knew I was going to put science notebooks to the test. Although I still knew very little about science notebooks, my professor emphasized the importance of utilizing the tool as soon as possible. “You can learn as you go,” she promised. That day during my planning time, I constructed twenty notebooks using loose-leaf paper and my trusty stapler. I decorated the cover of my model notebook and
created a Table of Contents on the second page. I was thrilled to show off my notebook to my students during science that day. During the reveal, Ethan’s eyes lit up and he let out a little squeal while out of the corner of my eye, I could see Brayden masking his face with his hands as he sunk into his chair. Over the next few weeks, my students continued to study the human body, and while some of my young scientists’ notebooks were overflowing with questions, predictions, and observations, others conveniently “lost” their notebooks. “I must have accidentally put it in the recycling bin,” claimed Brayden. I realized that there was a great deal more that I needed to learn about using science notebooks with third graders.

The purpose of my study, then, is to learn how to integrate the genre of expository writing and inquiry-based science through the use of science notebooks. There are several reasons why I believe this research is necessary. First of all, the Common Core State Standards have heightened the expectations of student outcomes. As I described earlier, my colleagues and I are implementing new educational programs for literacy and math, which are aligned to the Common Core, but research indicates that writing during science activities can have a significant positive impact on student achievement (Butler & Nesbit, 2008). I am intrigued to learn how my implementation of science notebooks might enhance my students’ proficiency in expository writing, especially for reluctant writers like Brayden.

**Study Approach**

As a teacher researcher, my sole purpose for conducting a self-study is to study my practice in order to improve it. LaBoskey (2004) highlights five essential
characteristics of self-study methodology that I have incorporated into my research: self-initiated and focused, improvement aimed, interactive, multiple, primary qualitative methods, and exemplar-based validation. Critical reflection of practice allows a teacher to make new discoveries and to construct new knowledge, which will ultimately help her refine her skills (LaBoskey, 2004). Continually striving to improve upon one’s practice is important for the individual teacher as well as the public (LaBoskey, 2004). Self-study is collaborative endeavor; the teacher-researcher must interact with colleagues as well as text in order to expand thinking, uncover misconceptions, and triangulate data (LaBoskey, 2004). It is also important for the teacher-researcher to gather multiple sources of qualitative data in order to gain a deep understanding of the topic being studied (LaBoskey, 2004). Finally, self-study should follow the same guidelines for trustworthiness used by all researchers and scholars, which boosts the validly transferability of the findings (LaBoskey, 2004).

Through self-study, I will investigate my process of developing and implementing teaching methods to integrate inquiry-based science and expository writing with my third graders. In addition to learning how to incorporate writing into science, I also intend to examine how my students, specifically those who struggle with literacy related activities, develop as writers of expository text.

**Overall Study Design**

I will initiate my research study over the course of five weeks. During week one I will introduce my students to the idea that scientists are also writers. I will encourage them to focus on the idea of how scientists use writing to help them build their
understanding of what they are doing. My students will have an opportunity to explore photographs of scientists’ (student scientists and professionals) lab books, or science notebooks, as we will refer to them. My students will decorate the covers of their own science notebooks created from loose-leaf paper stapled together. The following day, as we begin a study of water, I will model the essential elements of a science notebook entry on chart paper. My demonstration will include recording a research questions, a prediction, procedures, scientific drawings and findings, and a conclusion. Finally, I will ask the students to label these elements on the chart paper using brightly colored strips of paper. The science notebook entry, documented on chart paper, will be displayed on a bulletin board to serve as an anchor text for my young scientists.

Once students have practiced incorporating the elements of notebook entries into their science notebooks, I will begin to model the process of expository writing. My focus will be teaching procedural, descriptive, and explanatory writing through a series of minilessons. I will utilize portions of previous investigations for my models because it will be important that students understand how refining their writing will also enhance their work as scientists. The first expository writing lesson will focus on procedural writing, which aligns seamlessly with the procedure component of science writing. Using the procedure section from the previous science investigation, I will demonstrate how I can use transition words (to begin, next, last but not least) to sequence the procedural steps of the investigation. I will also share my written procedure with a peer so that she can read and precisely follow my written steps. This will reveal the accuracy and clarity of my writing. This may also reveal things such as inaccuracies or where writing may need to be clarified.
Descriptive writing will be the focus of my second minilesson. Just as before, I will use the investigation from the previous day to demonstrate how I expand my use of details as I record my observations and findings. I will explain that my elaboration will help to clarify my understanding and ultimately, reveal my in-depth thinking.

My final minilesson will emphasize strengthening conclusions through explanatory writing. I will demonstrate how my explicit teaching and the research I conducted using a variety of resources, such texts and the Internet extend my learning. I will then show my students how I use this new knowledge, along with my detailed descriptions recorded in my notebook as evidence to explain my learning.

**Role of Feedback**

In order to support my students as they develop as readers and writers of expository text, I will create opportunities to provide feedback (Butler & Nesbit, 2008). Feedback is quite possibly the most powerful tool for fostering success (Butler & Nesbit, 2008). Throughout the unit on water I will provide my students with feedback in several forms. I will confer with students in order to explore their thinking related to science concepts and expository writing. Conferring with students individually will allow me to meet their individual needs. Rubrics will be yet another means of providing my students with feedback. I will develop a rubric focused on science notebook entries, which will include five categories: table of contents, organization, scientific accuracy, scientific drawings, tables and graphs, and neatness and entries. A score of four for each category will exemplify the highest level of proficiency. After the presentation of each model lesson, my students will collaborate to develop rubrics for procedural, descriptive, and
explanatory writing. By encouraging my students to create the rubrics, they will have a concrete understanding of what is expected. I believe that providing my students with individualized, immediate, meaningful feedback will play an important role in their development as scientific writers and thinkers.

**Use of a Research Journal**

I will collect quantitative data through the use of a research journal. From the start of the unit until the very last day, I will generate entries immediately after school so that my experiences are still fresh in my mind. I anticipate that the notes I record during the lessons will also help me to generate my journal entries. These entries will include a brief summary of the lesson and more importantly, I will document my observations, thinking and wonderings about my experience. My reflections may focus on my approach to teaching, my experience with providing feedback, students’ reactions to my feedback, my thoughts regarding the use of science notebooks, and my views regarding the effectiveness of the integration of science and writing. In addition, I will include my observations related to my students’ progress as writers and thinkers and their struggles and attitudes toward the writing process.

**Rationale**

My rationale for conducting this self-study in the manner in which I have described above is based on theoretical practices and my personal philosophies related to teaching and learning. I strongly believe that science notebooks have the potential to be a powerful teaching and learning tool. Students can deepen conceptual understanding of
content as they engage in the writing process (Gilbert & Kotelman, 2005). Through the use of science notebooks, I can focus on teaching writing to promote my students’ use of strategic thinking and the construction of knowledge (Butler & Nesbit, 2008).

With the implementation of the Common Core State Standards, I believe that it is essential that my students interact more deeply with subject matter. In order to support my students as they learn to write informative/explanatory texts to examine a topic and convey ideas and information clearly, my students need explicit instruction and practice with procedural, descriptive, and explanatory writing in order to achieve this learning objective. At this point, most of my students struggle with this form of writing: their writing lacks structure, detail and clarity, which is why I have chosen to concentrate on expository writing for this study. I am confident that science notebooks will serve as an effective tool to enhance students’ expository writing skills so that they can master the Common Core writing standard and ultimately apply the skills in the real world.

I will focus on scaffolding instruction in order to support my students as they develop as thinkers and writers. Scaffolding involves explicit instruction and modeling by the teacher, guided practice, and independent inquiry. Routman (2000) defines scaffolding as “temporary but necessary support without which a task cannot be accomplished” (p. 24). Ediger (2012) claims that learning is the result of quality teaching, which makes scaffolding an essential part of the teaching process.

The first dimension of scaffolding instruction involves providing students with explicit instruction and modeling, which will occur during my minilessons. I will demonstrate how to create a science notebook entry that includes research questions, predictions, procedures, data, findings, and a conclusion. Then, I will focus my
instruction on specific elements of the entry to teach procedural, descriptive, and explanatory writing. My procedural writing lesson will involve demonstrating how to write clear and precise details in sequential order. I will also show my students how to enhance their findings by elaborating on the topic and incorporating scientific drawings, charts or graphs, and finally, I will demonstrate how to strengthen conclusion by using multiple sources to accurately support claims with evidence.

The process of scaffolding instruction involves providing students with the appropriate level of support so that they are able to gradually internalize the desired task (Routman, 2000). Effectively supporting students along the continuum of learning requires the sharing of constructive feedback. As Belcher (2012) recommends, I always begin my feedback with positive and specific remarks to encourage my writers. I also frame my feedback as suggestions rather than commands. Through the use my self-developed rubric and student generated rubrics, I can assist my students during conferences in addressing specific needs and refining their techniques as writers.

I believe that my use of a research journal will play an important role in my data collection process and in my analysis. A stated earlier, I will need to record a lesson summary immediately after school throughout the entirety of the science unit. In addition to the summary, it is also imperative that I reflect upon my experiences. I will discuss my development as a teacher implementing the Common Core State Standards, my practice teaching through an interdisciplinary framework, my desire to help my students develop as thinkers, writers, inquirers, my need to provide more authentic feedback, my growth as a researcher, and my aspiration to support my reluctant writers.
The combination of my reflections and the careful analysis of my students’ science notebook entries may help me pinpoint positive aspects of my teaching and areas in which I need to enhance my instruction and in turn, my students’ learning. Analyzing my data will also inform my teaching for future integrated science-writing units. I strongly believe that reflection is an important part of the teaching and learning processes. I am optimistic that reflecting on my experience will ultimately enhance my teaching methods and my students’ learning.

Summary

I am often extending instructional time for literacy and mathematics in order to incorporate all components of my school’s new educational programs aligned to the Common Core State Standards. I am hoping that the extension of these content areas will have a positive impact on my students’ academic achievement. Consequently, I am sacrificing science instruction. I am interested in exploring ways to maximize instructional time so that there is time in the school day for science.

Through an interdisciplinary unit of study, I will examine my process of learning to use science notebooks as a tool that my students can use to practice expository writing through science. I have also set out to discover how I can use science notebooks to support my students as they develop as writers, inquirers, and thinkers, especially those who are reluctant. Through modeling, I will explicitly teach my students about the elements of science notebook entries. My model lessons will refer to specific sections of entries to provide instruction related to procedural, descriptive, and explanatory forms of expository writing. I will support my students along the continuum of learning by
providing feedback during individual student conferences. My use of a research journal will allow me to document my discoveries related to my development as a teacher implementing the Common Core State Standards for expository writing, my practice teaching through an interdisciplinary framework, and my desire to help my students develop as thinkers, writers, inquirers. In addition, I will use my research journal to reflect upon my need to provide more authentic feedback, my growth as a researcher, and my aspiration to support my reluctant writers. Through my work as a teacher researcher undertaking a five-week qualitative self-study, I hope to enhance my interdisciplinary teaching methods so that I can capitalize on my students’ curiosities about the natural world while engaging them in authentic writing and science experiences.
Chapter 2: Literature Review

Writing is empowering! It is likely that students will invest themselves more in their writing when they receive explicit instruction related to the process of writing and the traits of good writing. Through writing workshop, educators can provide students with meaningful writing experiences while simultaneously teaching to Common Core State Standards.

Inquiry based learning is another instructional model that aligns seamlessly to the standards because students learn to conduct science in the same way that professional scientists conduct inquiries. As part of the inquiry process, students use science notebooks as a tool to write about their discoveries. Through a science-writing approach, students are motivated to develop as writers, scientists, and thinkers.

Writing Instruction in the Elementary Classroom

Students deserve frequent opportunities to practice the writing process, like professional writers. Likewise, it is crucial that students have a strong understanding of the qualities of good writing. Writing workshop is a sound instructional practice with a focus on exposure to high quality literature and encouraging students to read as writers (Calkins, 2006). Analyzing the compositions of other authors and exercising the writing process allows students to acquire the necessary skills to become proficient, lifelong writers.
The Writing Process

With expert teaching and extensive practice, all students have the potential to become proficient writers. According to Graham, MacArthur & Fitzgerald (2007), ensuring that students have a clear understanding of the process of writing is just as important as creating an environment that is conducive to writing. The writing process is a recursive cycle of writing activities, which students endure to produce polished pieces of writing (Tompkins, 2008). The five stages include prewriting, drafting, revising, editing, and publishing (Tompkins, 2008).

The first, and often neglected, stage of the writing process is prewriting. During this stage, the writer selects a topic, considers the purpose for writing as well as the audience, and outlines and organizes ideas (Tompkins, 2008).

Next, the writer generates a series of drafts to refine ideas (Tompkins, 2008). Throughout this stage, the emphasis is on composing ideas rather than conventions.

The following stage, revising, focuses on clarifying ideas by rereading the draft, sharing the writing composition, and making changes based on the feedback from others (Tompkins, 2008). It is common for educators to share exemplary pieces at this point to support writers as they develop their work (Tompkins, 2008). Students may also revise the work of others in order to prepare them for revising their personal writing pieces (Tompkins, 2008).

Once students have focused primarily on the content of their writing, they are ready to begin editing (Tompkins, 2008). This stage calls attention to making the composition readable. The teacher may insert a variety of proofreading marks into the student’s writing so he can improve the mechanics: capitalization, punctuation, spelling,
sentence structure, usage, and formatting, (Tompkins, 2008). Tompkins (2008) believes that students are motivated to revise and edit their writing in order to published and share it with others.

During this final stage, students typically recopy their writing so that it can be displayed on a bulletin board, made into a bound book, read at a school assembly, submitted to a school magazine or writing contest, read during “author’s chair,” or sent to another individual (Tompkins, 2008).

It is critical that educators teach the writing process so that students learn to refine their work like published authors (Graham et al., 2007). Providing students with explicit instruction related to the writing process will encourage them to personalize the writing process by jumping between stages to suit their needs and to ultimately enhance the quality of their writing (Tompkins, 2008).

The Traits of Good Writing

By exercising the five stages of the writing process, students can naturally communicate with others. In addition to receiving explicit instruction related to the writing process, students must also learn a repertoire of strategies that lead to success in writing (Graham et al., 2007). Educational researchers like Spandel (2008) recognize the significance of teaching six traits of writing: ideas and content, organization, voice, word choice, sentence fluency, and conventions, so that students can work to improve the content and readability of their writing. According to Spandel (2008), “[The traits] are not a novelty; they’re simply the essence of what makes writing work and so are an inherent part of every piece of writing ever generated and every piece to come.” (p. 2).
Ideas and content is the overall concept of a composition (Spandel, 2008). Through prewriting strategies such as journaling, graphic organizers, brainstorming, and free writing, students can begin to deliver the main message or story line (Graham et al., 2007). Both Spandel (2008) and Graham et al., (2007) describe the author’s ideas as the heart and soul of his or her work.

Organization refers to the design and structure of a composition (Spandel, 2008). The organization of a writing piece has the power to make the author’s message both understandable and memorable (Spandel, 2008). The acronym CRAFT is often helpful in teaching the organization of writing: C is the context of the writer, R is the role or stance the author will undertake, A is the audience in which the author is communicating with, F is the format of the writing piece, and T is for the writer’s topic (Graham et al., 2007).

Graham et al., (2007) refer to voice as “an author’s unique style and personality as reflected in his or her writing” (p. 39). An author uses tone, vocabulary, syntax and expression to deliver the message in a personal manner (Graham et al., 2007). Students can practice mimicking the voice of writers such as Dr. Seuss or Edgar Allen Poe to better understand how voice is linked to style (Graham et al., 2007).

Students must recognize that word choice contributes to the clarity of their writing, but it is also a powerful tool for evoking emotion (Spandel, 2008). Graham et al., (2007) recommends using poetry to promote the acquisition of new language. Spandel (2008) also stresses the importance of studying the work of others to teach, as well as to enjoy, the power of language.

Sentence fluency is the rhythm and flow of language (Spandel, 2008). It is important for students to learn to manipulate grammar and syntax in order to generate
fluid compositions (Graham et al., 2007). Through rereading their written work, students can discover ways to connect sentences and change punctuation to improve rhythm.

Conventions are the mechanical aspects of writing, which includes spelling, grammar, punctuation, and the use of capitals (Spandel, 2008). The presentation of the composition is also an element of this trait (Spandel, 2008). Writers should be instructed to reread their work so that they can identify and correct errors (Graham et al., 2007).

In order for students to learn the traits of good writing through the process of writing, students should be provided with opportunities to write daily (Spandel, 2008). In addition, students should write for a variety of purposes. Writing workshop is an approach that supports both the process of writing and the explicit instruction of skills and strategies of effective writing (Calkins, 2006).

### Writing Workshop

Research by Fountas and Pinnell (2001), Calkins (2006), and Tompkins (2008) prove that writing workshop is an effective instructional approach for supporting student writers. According to Fountas and Pinnell (2001), “The purpose of the writing workshop is to give students opportunities to write within the school day and to provide appropriate, intensive, targeted instruction to the whole group, small groups, and individuals” (p. 50). Students work to develop craft, acquire strategies and to communicate across three contexts: independent writing, guided writing, and investigations (Fountas & Pinnell, 2001).

During independent writing, students focus on developing their own writing pieces. A student writer, or the teacher, may begin the independent writing block by
analyzing a particular craft depicted in an author’s work (Fountas & Pinnell, 2001). This “writer’s talk” is followed by a 5-15 minute minilesson designed to meet the needs of the writers (Calkins, 2006). The teacher may also make an effort to become informed regarding the status of each writer. For 30-45 minutes, students will engage in the writing process to refine their work while the teacher confers with students to support their individualized needs (Tompkins, 2008). Students may also hold peer conferences during this time (Tompkins, 2008). The independent writing block concludes with group sharing of publications and feedback in the form of compliments and questions (Tompkins, 2008). Tompkins (2008) also notes the importance of reading aloud to students so they learn about authors and hear good examples of writing.

The focus of guided writing is to provide a small group of students with explicit instruction related to craft, strategies and skills those particular writers need support in developing (Fountas & Pinnell, 2001). The small group lesson topic follows the topic introduced during the minilesson. Lessons may center on topics such as text structure, word choice or technology to publish writing (Fountas & Pinnell, 2001). It is common for the teacher to assemble groups based on her observation of student needs, but groups may also be organized based on student requests for help with certain aspects of writing (Fountas & Pinnell, 2001).

Investigations are an extension of the writing experience. Students read and write to deeply explore topics such as a piece of literature or a content area (Fountas & Pinnell, 2001). Learning may occur individually, in pairs or in small groups. The culminating activity is a presentation, which may take on various formats. The purpose of this element of the writing workshop is for students to understand the strong connection
between reading and writing and to help students develop oral language skills (Fountas & Pinnell, 2001).

Through writing workshop, students can be explicitly taught the process of writing as well as the qualities of good writing in an authentic way (Calkins, 2006). The writing workshop model is also differentiated in that it encourages students to work at their own pace while providing a predictable schedule for all writers. Students are also encouraged to reflect on the skills they have developed throughout their writing experience. These sound instructional practices can also be implemented while teaching to the Common Core State Standards.

**Common Core State Standards for Writing**

To ensure that all students are college and career ready in literacy and mathematics by the time they complete grade twelve, the nation released the Common Core State Standards in 2010 (http://www.corestandards.org/). A total of forty-five states have adopted the standards, including New York in January 2011 (http://www.corestandards.org/). According to a recent study by the OECD’s Programme for International Study Assessment (PISA), out of thirty industrialized countries, the United States ranked twenty-fifth in math, fifteenth in reading, and twenty-first in science achievement (http://www.corestandards.org/). Consequently, a significant gap has formed between the performance of American students and that of students in other industrialized nations. The authors of the Common Core designed the standards to align with the high demands of college and real life careers as well as the learning expectations of high performing countries around the globe (http://www.corestandards.org/). By
setting clear and high standards, students will be in a better position to compete in the
global economy (http://www.corestandards.org/).

The Common Core State Standards for English language arts place an equal
emphasis on both reading and writing, unlike the No Child Left Behind mandates
(Calkins, Ehrenworth & Lehman, 2012). Students are expected to demonstrate their
reading skills through writing. The standards include ten anchor standards for reading as
well as for writing with an additional standard for each created by New York State. The
anchor standards highlight the definitive expectations for K-12 students by the end of
each school year. The authors of the Common Core point out that the anchor standards
and specific grade level standards are intended to compliment one another. While the
anchor standards are broad, the grade level standards are more specific; together, the
standards describe the skills and understandings that all students must master by
graduation (http://www.corestandards.org/). Specific to writing, the Common Core
Anchor Standards for Writing focus on text types and purposes, production and
distributing of writing, research to build and present knowledge, range of writing, and
added by New York State, responding to literature (http://www.corestandards.org/). The
K-12 standards follow the same outline but include subheadings for each category and
are specific to each grade level. For example, the Common Core
(http://www.corestandards.org/)Anchor standard two for writing states that students will
“write informative/explanatory texts to examine and convey complex ideas and
information clearly and accurately through the effective selection, organization, and
analysis of content.” (p. 26). The corresponding standard two defined for grade three
states students will “write informative/explanatory texts to examine a topic and convey
ideas and information clearly. Related to this Common Core
(http://www.corestandards.org/) standard are four substandards: students will “A.
introduce a topic and group related information together; include illustrations when
useful to aiding comprehension. B. develop the topic with facts, definitions, and details.
C. use linking words and phrases (e.g., also, another, and, more, but) to connect ideas
within categories of information. and D. provide a conclusion statement or section.” (p.
30).

Haskins, Murnane, Sawhill and Snow (2012) emphasize the importance of
establishing standards in order to distinguish the expectations of the knowledge, skills,
and competencies that individuals must possess. However, these researchers also bring to
light the idea that rigorous learning standards are one part of an overall strategy for
literacy improvement (Haskins et al., 2012). Another essential component of boosting
literacy achievement involves improving the quality of teaching so that learning aligns to
the Common Core (Haskins et al., 2012). It is essential that educators are well
acquainted with the Common Core so that they can effectively implement challenging
curricula that encourages all students to master the standards (Haskins et al., 2012).

When educators commit to adopting an interdisciplinary approach to learning,
suggested by the authors of the Common Core State Standards, the result can have a
powerful impact on student learning. Inquiry based learning is another instructional
method that extends beyond the science classroom to maximize the quality of learning
experiences for all students.
**Inquiry Based Learning**

Inquiry based learning is a teaching method that involves learning by doing (Martin, 2000). This scientific process begins when the teacher, a guide and facilitator, poses an open-ended question, which sparks students’ curiosity (Martin, 2000). Students may then generate their own questions about the topic or subject matter. These questions naturally should lead the students to construct possible conclusions and conceptualizations (Martin, 2000). Conducting research allows them to test these ideas. Students may discover that research does not align with their current state thinking, which promotes the process of generating new conceptualizations (Campbell & Fulton, 2003). Throughout this scientific process, the teacher vigilantly listens to students and poses questions to better understand their thinking and provide guidance (Martin, 2000). Through discussion with the teacher and peers and further investigation, students are encouraged to refine their conclusions and schema, leading them to the outcome and ownership of new knowledge (Martin, 2000).

Inquiry based learning involves the use of science process skills which include: observing, classifying, communicating, measuring, predicting, inferring, identifying and controlling variables, formulating and testing hypotheses, interpreting data, defining operationally, experimenting, and constructing models (Martin, 2000). According to Campbell and Fulton (2003), students practice and apply these process skills at varying levels, which can be revealed in students’ documentation of science investigations. Students may record their learning in various ways such as scientific drawings, charts, tables, graphs, explanations, and lists (Campbell & Fulton, 2003). These recordings also serve as a critical tool for students to think deeply about science concepts.
Implementing the inquiry model provides students with authentic learning experiences, because they learn to conduct science in a similar fashion as professional scientists. As part of the inquiry process, students are expected to document and communicate their findings with others (Campbell & Fulton, 2003). Learning is hands-on and students are engaged in the learning process. Ultimately, all students are empowered because there are no wrong answers; the goal is for students to take control of their learning through exploration to construct meaning. As a result, students become self-directed learners who value their thinking.

The Integrated Science-Writing Approach

Expository writing in science encourages students to think scientifically to extend their conceptual understanding of concepts (Fulwiler, 2007). To effectively implement the science-writing approach, Fulwiler (2007) emphasizes the careful balance of science experiences and writing instruction so that they can enhance each other. To effectively integrate writing and science, Fulwiler (2007) recommends separate science and science-writing sessions.

Science Sessions

Science sessions include four major stages: engagement, active investigation, shared reflection, and application (Fulwiler, 2007). During stage one, students use their science notebooks to begin activating prior knowledge related to previous investigations. Students also engage in focused discussion around questions posed by the teacher, which may also lead students to develop their own questions. Students will record the
investigative question in their notebook, and after more discussion, students record a prediction. The teacher must model how to generate a prediction that includes reasoning. In addition, it is necessary for the teacher to model other formats of expository writing such as charts, tables, graphs, observation notes, diagrams, and scientific illustrations (Fulwiler, 2007). Students should also be instructed about the importance of controlling variables (Fulwiler, 2007).

During the second stage of the science session, students are involved with handling concrete materials to collect data related to the research question (Fulwiler, 2007). In order to maximize their focus, writing is minimal, however, if students are gathering quantitative data, this information should be recorded. Observations can be noted after students have had time to explore the material. The role of the teacher is to visit groups of students to promote discussion. Students can think and act like scientists by reflecting on ideas and using scientific language (Fulwiler, 2007).

Stage three of the science session involves students meeting in an area of the classroom where they can collaborate as a whole group. Students should also be able to view the expository writing (tables, graphs, word banks, diagrams, scientific drawings) modeled by the teacher. One set of materials from the science investigations should be available so that students can utilize the materials to reflect on their thinking and learning. Fulwiler (2007) claims that students need ample experience with concrete materials so that they can begin to develop and deepen abstract thinking, which is essential to teaching writing in the science curriculum. According to Fulwiler (2007), “When students have trouble understanding a new concept, and then writing about, it is often because they have spent too little time with the concrete materials or moved too
quickly from communicating about the concrete experience to understanding that experience in a more generalized or abstract way” (p. 18). As students engage in shared reflection, the teacher acts as a facilitator by asking questions that lead students to shape answers to the research questions. Students require opportunities to discuss their thinking and to practice science language with others so that they can more easily apply these skills to science writing. During this stage, the teacher may also find it necessary to add new vocabulary to the science word bank, emphasize important science language, require that students respond to questions in complete sentences to improve oral language, model scientific language and thinking, or collaborate with students to generate data tables and graphs, and graphic organizers. (Fulwiler, 2007) By the conclusion of stage three, students have established a clearer understanding of the science concept and may have also developed new questions surrounding the investigation.

The final stage of the science session involves applying new learning to real world situations. Furthermore, the knowledge students constructed may guide them into another investigation or additional research (Fulwiler, 2007). Science notebook writing is not exercised during this portion of the science-writing approach.

**Science-Writing Sessions**

Science-writing sessions serve several purposes. For one, students review the previous science investigation (Fulwiler, 2007). Also, the teacher utilizes the session to teach minilessons related to model expository writing in science (Fulwiler, 2007). In addition, students also use this time to independently generate science notebook entries (Fulwiler, 2007).
Science-writing sessions begin with the class reviewing the content that was explored in the preceding science investigation. Concrete materials are used to stimulate the students’ reflections and conclusions related to the investigation. In order to ensure that students are active participants in the discussion, the teacher poses questions for students to discuss (Fulwiler, 2007).

The next phase of science-writing involves students’ engagement in shared writing activities. Through minilessons, the teacher provides explicit instruction to demonstrate the use of expository writing in science (Fulwiler, 2007). While the teacher models how to structure the writing, the students are responsible for providing the content by offering their observations, evidence, and thinking (Fulwiler, 2007). For instance, Fulwiler (2007), shares an example that involved a class of fourth graders investigating what happens to the brightness of a bulb when the length of the wire in a closed circuit is altered (Fulwiler, 2007). The teacher modeled how to write a conclusion that explained the research question. The students discussed the answer to the questions and were prompted to echo the question as well as to support response with evidence. The teacher introduced language such as *for example* and *for instance* to lead into the evidence and data. The teacher also demonstrated how to incorporate a summary of the data into the conclusion with assistance from the students. Using words such as *therefore* and *as a result*, the teacher finally modeled how to state the conclusion based upon the students’ relevant evidence (Fulwiler, 2007). The teacher then modeled how to incorporate the students’ inferential thinking into the conclusion by using language such as, “*I think this because.*” This portion of the conclusion required students to recognize the cause and
effect relationship between length of the wire and the brightness of the light bulb (Fulwiler, 2007).

The third step in science-writing sessions includes scaffolding instruction. Fulwiler (2007) suggests the teacher remove shared writing from view before students begin writing on their own. In its place should be the model from shared writing. For example, the scaffolding from the previous lesson would be:

- Echo the question (topic sentence)
- “For example” or “For instance” (introduce evidence)
- “Therefore” or “As a result” (introduce concluding statement)
- “I think this because” (introduce inferential thinking)

Step four of science-writing builds on the previous three stages. Students apply what they learned through scaffolding to write independently. The fourth grade students learning about circuits were able to write a conclusion section using the text structure modeled by the teacher. All students were actively engaged in thinking and writing like scientists as a result of the explicit instruction and careful guidance from the teacher.

When the science writing approach is effectively implemented, students are empowered because they not only build knowledge about the world in which they live, they also acquire the basic tools that can greatly enhance other learning experiences (Saul, 2004). In addition, the process of making discoveries related to the discoveries of others is an authentic and highly motivational method for developing and refining important literacy skills (Saul, 2004). In order for students to develop a strong understanding of science, they must apply essential literacy skills such as writing (Saul, 2004). Using science notebooks in the classroom can help to achieve this important goal.
Science Notebooks

Science notebooks are a learning tool used in classrooms to promote the understanding of scientific concepts (Baxter, Bass & Glaser, 2001). Like professional scientists, students can use notebooks to record questions, evidence of thinking, data, scientific drawings, and conclusions (Nesbit, Hargrove, Harrelson & Maxey, 2004). Scientists of all types greatly rely on this information to help make sense of investigations. The entire process of documenting thinking, findings, and conclusions encourages scientists to make new discoveries.

Scientists can generate notebook entries to accompany the scientific method and use of scientific process skills. Campbell and Fulton (2003) describe science notebooks as expository text that students create and use to confirm and extend ideas both during and after science investigations. Students ask questions, make predictions, record procedures, and document findings and new learning within one entry (Campbell & Fulton, 2003). Science notebooks are an authentic means for students to learn about the world in which we live (Nesbit et al., 2004).

In 2000, first grade students in New Hanover County, North Carolina began using science notebooks to compliment a newly adopted inquiry-based science program (Nesbit et al., 2004). While engaging in investigations on pumpkins, the students generated notebook entries to extend their learning (Nesbit et al., 2004). After the first graders freely explored pumpkins, the class developed a list of “What if” questions in order to zero in on one particular investigable question. One such question was, “Will pumpkins float when placed in a tub of water?” At this point, the teacher introduced students to
science notebooks, reinforcing the idea that scientists document each and every experiment (Nesbit et al., 2004).

The students began their science notebook entry by writing their name, date, and time in the upper right hand corner of the page (Nesbit et al., 2004). Next, they recorded the research question as well as a prediction (Nesbit et al., 2004). The students then collaboratively discussed the materials they would need to conduct their research and wrote the procedures to test whether the size of a pumpkin affects its floating ability. In addition to writing the steps that were followed, students included drawings with labels to illustrate what they did (Nesbit et al., 2004). During this phase of the investigation, the teacher instructed students about the importance of controlling variable in order to increase the validity of results (Nesbit et al., 2004). Students documented their findings and drew their line of learning (LOL) (Nesbit et al., 2004). The line of learning indicates a point during the investigation in which the teacher presents instruction or research is conducted to further the students’ knowledge related to the topic of study. After receiving explicit instruction about the topic from the classroom teacher, students summarized what they had learned about floating pumpkins (Nesbit et al., 2004).

Sixth grade students in El Centro School District in California also used science notebooks to document scientific investigations (Butler & Nesbit, 2008). Like the first graders in North Carolina, Mrs. Bee’s students in California began each entry with the date and time. The teacher explained that this was necessary because scientists keep thorough records to effectively and efficiently maintain and share findings (Butler & Nesbit, 2008). As part of an investigation of water, Mrs. Bee asked her students, “How many drops of water do you think can fit on this penny?” Her students recorded the
research question along with a prediction in their science notebooks. Mrs. Bee reminded her students that predictions should be supported with evidence.

Just as the first graders had done, the sixth grade class discussed the procedures of the investigation with fellow scientists. Their conversation also focused on the importance of controlling variables in order to produce valid results. The students recorded the procedures of the investigation in their notebooks. In order to support her students in creating detailed and precise procedural writing, Mrs. Bee had them share their writing with others (Butler & Nesbit, 2008). Partners followed the procedures to check the writer’s accuracy and clarity, and students were encouraged to make corrections to their procedural writing (Butler & Nesbit, 2008).

As Mrs. Bee’s students documented their findings, many students commented on how surprised they were to discover just how many drops of water were able to fit on the penny (Butler & Nesbit, 2008). Based upon her students’ writing, Mrs. Bee recognized a need for introducing precise language. Mrs. Bee introduced scientific vocabulary and students were given the opportunity to write about their new learning. Mrs. Bee also encouraged her students to utilize texts and Internet sources in order to revisit and expand their understanding of surface tension (Butler & Nesbit, 2008). Through the use of science notebooks, Mrs. Bee challenged her students to use the process of writing to acquire new learning, to produce a personal response to an idea, and to clarify written communication (Butler & Nesbit, 2008).
The Benefits of Using Science Notebooks in the Classroom

There are many benefits to using science notebooks in the classroom (Gilbert & Kotelman, 2005, Nesbit et al., 2004). Students can use science notebooks as thinking tools that promote the development of essential literacy skills. Educators can also utilize science notebooks as a means of differentiating instruction to better meet the individualized needs of all students. In addition, teachers can analyze writing samples collected in science notebooks to provide an accurate record of students’ thinking and level of understanding about a topic or concepts. For example, Mrs. Bee’s students generated science notebook entries to document their increased level of knowledge regarding surface tension (Butler & Nesbit, 2008). These entries served as an authentic means for Mrs. Bee to assess her students’ learning (Butler & Nesbit, 2008). Her students’ notebook entries were also used as a tool to guide her instruction (Butler & Nesbit, 2008).

Using Science Notebooks to Promote Thinking

Campbell and Fulton (2003) highlight how students’ use of science notebooks empowers them to become active participants in their own learning. According to Campbell and Fulton, (2003), when students are first introduced to science notebooks, they tend to be focused on facts and data, and as they gain more experience with notebooks, they learn to view them as a tool for making connections that expand learning. Students can use the notebooks to connect their observations with previous scientific and real world experiences. With practice, students’ written explanations may demonstrate their ability to synthesize their thinking and new learning (Campbell & Fulton, 2003).
The sixth grade students in El Centro School District in California used their science notebooks to foster deep thinking about science concepts (Butler & Nesbit, 2008). According to Butler and Nesbit (2008), through writing, students were able to contemplate their current thinking and uncover misconceptions to construct new understanding. Butler and Nesbit (2003) state, “The metacognitive awareness produced by writing can serve as a catalyst for further learning” (p. 137).

Similarly to the first grade students in New Hanover County, North Carolina, first and second grade students at Miller Elementary School in Tucson Arizona regularly began using science notebooks with an inquiry-based science program (Gilbert & Kotelman, 2005).

Shortly after implementation of science notebooks, the teachers recognized that the science notebooks were a way for the students to construct and deepen their conceptual understanding of snails (Gilbert & Kotelman, 2005). Students created scientific drawings in their notebooks to illustrate their careful observations. The teachers agreed that students were engaging more deeply with the topic because of their use of science notebooks. Students took the initiative to record their own questions relevant to the investigation, which demonstrated their understanding of the snails (Gilbert & Kotelman, 2005). As a result of using science notebooks, students were generating more detailed drawings. Prior to using the notebooks, students were personifying animals. In previous units, the students created only simple sketches of animals or added human characteristics to their drawings. Now, students were creating drawings with more accuracy (Gilbert & Kotelman, 2005).
Using Science Notebooks to Stimulate Literacy Skills

Students can have opportunities to practice three major dimensions of literacy as they use science notebooks: written communication, oral communication, and reading (Campbell & Fulton, 2003).

Writing

Science notebooks can be a natural way for students to develop writing skills. Before, during and after students investigate, they write about their experiences and discoveries (Campbell & Fulton, 2003). Students record predictions before seeking answers to a research question. During the investigation, students record procedures and data. After the investigation, students can demonstrate their thinking by writing a summary of their learning, which involves reflecting on their work to clarify their writing (Campbell & Fulton, 2003).

The essence of science notebook is to help students develop a deeper understanding of science concepts. Teachers can encourage their students to utilize various methods of recording information such as complete sentences, phrases or lists, and visuals such as diagrams or tables (Campbell & Fulton, 2003).

While first and second graders in at Miller Elementary in Tucson, Arizona were learning about snails, they were also developing as writers of expository text (Gilbert & Kotelman, 2005). They learned how to write various forms of expository text including procedural, narrative, and descriptive (Gilbert & Kotelman, 2005). They also used labels to add detail to their diagrams and charts.
The teachers at Miller Elementary recognized that as writers who were struggling continued to use science notebooks to learn science concepts, they became more comfortable with the process of writing (Gilbert & Kotelman, 2005). Students were encouraged to use both written and visual text to communicate. In addition, teachers discovered that students generalized writing skills to other writing tasks, such as book reports and creative writing activities (Gilbert & Kotelman, 2005).

Over time, the first and second grade students in New Hanover County Elementary Schools demonstrated significant growth in writing because of their dedication to science notebooks (Nesbit et al., 2004). Similarly to the students at Miller Elementary School, students in New Hanover County generalized their science writing skills to other content areas such as reading and math. For example, the students learned how to incorporate visual text such as graphs, tables and maps into their notebook entries, which also supported their comprehension of informational text and their understanding of the problem solving process where visual text feature are plentiful.

In addition to the transfer of skills, the students had also developed greater stamina. By the end of the year, students were producing more text and writing for an extended period of time (Nesbit et al., 2004). Over time, both the sixth grade students in El Centro School District in California and the first and second graders in New Hanover County, North Carolina were able to participate in investigations of greater length and yield more in depth entries related to each investigation.

Campbell and Fulton (2003) recommend that teachers encourage their students to share their science writing with others, just as professional scientists do. This provides
students with an opportunity to orally practice their writing and also can make the writing process more meaningful for students.

Oral Language

As students engage in science investigations, they can actively discuss their thinking in pairs, small groups, and as a class. When students verbally share ideas, they are not only communicating with others, they are also constructing meaning as they work through thinking, collaborating, and receiving feedback from others (Campbell & Fulton, 2003). During investigations, students have opportunities to informally converse with peers about their observations and the data they are collecting (Campbell & Fulton, 2003). It is through these rich classroom discussions, that students can begin to make connections that help them develop a deeper understanding of the science concept (Campbell & Fulton, 2003). Campbell and Fulton (2003) suggest that teachers maximize opportunities for students to engage in science discussion as they can promote learning. Self-talk is one way for students to make sense of a challenging idea or concept (Campbell & Fulton, 2003). Campbell and Fulton (2003), refer to self-talk as a precursor to writing. Students predict, explore, and analyze as they communicate with their peers and teachers without making the ideas permanent on paper (Campbell & Fulton, 2003). Campbell and Fulton (2003) say that self-talk can “assist students in feeling more secure, and as students feel secure in their thinking, they may be more open to recording their thinking in their notebooks” (p. 75).

Ediger’s (2012) research also aligns with the idea that students’ use of science notebooks can enhance their literacy learning. Students can acquire new vocabulary as
they engage in investigations. They can practice using new language through conversation, writing, and visuals (Ediger, 2012). When the Miller Elementary School principal entered the first and second grade classrooms, he overheard students excitedly using rich, colorful language as they engaged in scientific discussions about what they were learning (Gilbert & Kotelman, 2005). Through the use of science notebooks, the teachers had discovered a way of tapping into the students’ love for learning while supporting them in becoming more effective oral communicators (Gilbert & Kotelman, 2005).

Reading

Ediger (2012) points out that great scientists are also great readers. In today’s world, individuals must be able to read and understand informational text (Campbell & Fulton, 2003). Science notebooks can serve as a tool to promote authentic reading.

The use of science notebooks requires the act of reading and rereading of entries (Ediger, 2012). When students who are reluctant or struggling reread their science writing, they are practicing with text at their level (Campbell & Fulton, 2003). As they gain experience and confidence, they are motivated to interact with other pieces of informational text. Students in Mrs. Bee’s sixth grade class in the El Centro School District spent a great deal of time rereading their data before drawing conclusions about the relationship between the number of drops of water that fit on a penny and surface tension (Butler & Nesbit, 2008).

When science is taught through an interdisciplinary framework, students have opportunities to spend a great deal of time reading about science related topics. Students
can utilize other sources of information to seek answers to research questions. Other forms of informational text may also be used to generate additional research questions related to the science concept (Campbell & Fulton, 2003). Campbell & Fulton (2003) say, “students are prepared to be critical readers because they are to some degree now experts themselves. They question text rather than accept everything they see in print” (p. 77).

Yopp (2006) claims information text plays a significant role in the elementary school classroom because exposure influences literacy development and serves the purpose of extending hand-on science investigations. It also has the potential to generate excitement and motivation for learning about the world in which we live (Yopp, 2006). Students can conduct research to build upon their background knowledge by applying new learning to science notebook entries (Yopp, 2006).

**Using Science Notebooks to Guide Instruction**

When students use science notebooks to document their thinking, teachers may use notebooks to assess students’ learning, misconceptions, and organizational skills (Gilbert & Kotelman 2005). According to Nesbit (et al., 2004), “data from a science notebook [is a powerful tool that] provides the teacher with a true record of each student’s thinking and level of understanding over the course of the investigation” (p. 22). A teacher should use this information to guide instruction to ultimately enhance the quality of learning that takes place in the classroom (Nesbit et al., 2004).

At Miller Elementary School in Tucson, Arizona, first and second graders studying snails recorded questions about the creatures’ diet in their science notebooks
(Gilbert & Kotelman, 2005). Upon reading her students’ notebook entries, the teacher decided the next investigation would relate to what and how snails consumed food (Gilbert & Kotelman, 2005).

Visual text (tables, charts, graphs, and diagrams) is an integral component of science investigations and notebook entries. The teachers at Miller Elementary School recognized that students would need explicit instruction in regard to how to visually communicate information (Gilbert & Kotelman, 2005). The teachers taught students that depending on the data or information, one method of visual text may be better suited than others (Gilbert & Kotelman, 2005). For example, the students spent time observing and recording what and how much snails were eating over time (Gilbert & Kotelman, 2005). The teachers developed a series of lessons demonstrating how to visually represent this information through graphing (Gilbert & Kotelman, 2005).

Ediger (2012) points out that educators should also use science notebooks to assess the quality of their teaching. Good writing is the product of good instruction. When teachers effectively model and scaffold instruction, students will learn to express their thoughts through written communication, a skill which will extend beyond the classroom (Ediger, 2012).

Science notebooks can be helpful in monitoring a student’s thought process over time. (Ediger, 2012) As a result, the teacher can make informed decisions regarding what needs to be done to move the student along the learning continuum. When teachers take advantage of using science notebooks to guide instruction, they become better facilitators of learning and students advance as scientists, writers, and thinkers (Butler & Nesbit, 2008).
Using Science Notebooks to Differentiate Learning

In every classroom, students make up a broad spectrum of ability levels and needs. Science notebooks can be a beneficial way to meet the needs of diverse learners. Mrs. Bee’s sixth grade students documented investigation findings in ways that made sense to them (Butler & Nesbit, 2008). While some sixth grade scientists created charts or graphs to show their thinking, others made scientific drawings with labels or wrote descriptions (Butler & Nesbit, 2008).

As students record their thinking in science notebooks, it is essential that the teacher provides constructive feedback (Gilbert & Kotelman, 2005). Feedback can be individualized based on the student’s strengths and needs. With guidance, students who are reluctant can develop as writers of expository text (Gilbert & Kotelman, 2005). They may begin by expressing their learning through visual text and with individualized feedback, can work to explain their new knowledge through written communication (Gilbert & Kotelman, 2005). Students who are advanced, on the other hand, can also work at their own pace by gradually increasing the complexity of their writing (Gilbert & Kotelman, 2005).

English language learners can also use science notebooks to make sense of their learning (Gilbert & Kotelman, 2005). Depending on the level of language acquisition, English language learners may begin to create scientific drawings and write explanations of learning their native language and then begin using both languages as they develop English (Gilbert & Kotelman, 2005).
Nesbit et al. (2004) suggests that teachers provide feedback that is focused on students’ specific level of understanding so that students can eventually perform tasks independently with confidence and competence. Teachers can use science notebooks as a tool for understanding students’ thinking. As a result, the first and second grade students in New Hanover County, North Carolina developed as scientists and writers of expository text because their teachers were guiding them along an individualized learning continuum (Nesbit et al., 2004). Over time, students also showed growth in other content areas because of their individualized attention (Nesbit et al., 2004). For example, the students generalized skills related to visual text features (graphs, charts, and diagrams) to reading and math.

It is also important to note that the use of science notebooks in fourth grade classrooms in New Hanover County, North Carolina impacted standardized test scores (Nesbit et al., 2004). According to Nesbit et al., (2004) “There are startling results on student achievement when an active science program that includes science notebooks is implemented. Student achievement in science, mathematics, reading, and writing is greatly improved” (p. 22). Students nearly doubled their scores on standardized tests and sixth graders’ scores almost quadrupled (Nesbit et al., 2004).

For any student, a science notebook is a personal record of learning that can foster a sense of ownership and spark intrinsic motivation. The use of science notebooks can encourage students to make discoveries about the world in an authentic and meaningful way. Through an interdisciplinary framework, students can ultimately develop the necessary skills to extend their learning beyond the classroom.
Chapter 3: Methods and Procedures

In order to effectively prepare my students for college and the real world, I provide my students with ample opportunities to practice and develop their literacy and math skills, I often extend the amount of time I am using for literacy and math instruction to address all of the components of the new educational programs my school has adopted. It is my hope that devoting more time to skill development will enable my students to reach a higher level of academic achievement. My time management choices, however, have resulted in a new problem: extending instructional time for literacy and math has meant sacrificing time for teaching and learning topics related to science and social studies. I believe all subject areas are equally important in a student’s education, and therefore, I am eager to devise a strategy that allows me to make better balance time for teaching and learning across all content areas.

During this study, I will use an interdisciplinary framework and attempt to integrate science topics about water and expository writing (descriptive, procedural, and explanatory) as a way to maximize my instructional time so that students can experience optimal learning. I explore the research question: How can I use science notebooks as a tool to teach expository writing?

I will adopt a self-study approach in order to seek answers to my question and to ultimately improve my practice as an educator. My study will align with LaBoskey’s five characteristics of self-study methodology as described in chapter one (LaBoskey, 2004). Through my work as an educator, I have generated a need to conduct this research based upon my desire to enhance my teaching and my students’ learning. Throughout
my study, I will interact with my students and colleagues, my thesis advisor and my critical friend to develop new insight related to my topic of study. Through qualitative measures, observation and journaling, I will develop a better understanding of my students and myself, and finally, I will establish validity by adopting standards of normal research practice.

In this chapter, I will discuss my role and positionality as the teacher researcher, the context of my study, my process of collecting and analyzing data, the procedure, criteria for trustworthiness as well as the limitations of my study.

**Participant**

I have decided to conduct a self-study to gain deeper insights into how I can integrate aspects of science with aspects of literacy, specifically the genre of expository writing, as a way to explore how I can meet the demands of the Common Core while supporting the diverse needs of my third grade students. I will be the lone participate of the study, although I will discuss and reflect upon my interactions with my students and their reactions to my instruction.

**My Positionality as the Researcher**

I am a white, middle class female in my early thirties with a total of eight years of experience working as an educator in a public school system. In 2005, I received my undergraduate degree in elementary education and special education from the State University of New York at Geneseo. I am a graduate of the rural school district where I have happily established my career. I began my teaching career as a first grade teacher
and six years ago made the move to third grade. As a third grade inclusion teacher, I am responsible for teaching the content areas of reading, writing, word study, mathematics, and science, with the exception of social studies. A neighboring third grade teacher and I have teamed up so that our classes switch two days per week for science and social studies. I am the designated science teacher. Due to time restraints, my team teacher graciously agreed to discontinue switching classes so that I could complete my study within five consecutive weeks. After the completion of my study, my students will no longer receive science instruction, but attend social studies Monday through Thursday until the end of the marking period. As a result, students will have received five weeks of instruction in both subject areas.

Routman (2000) states that “our beliefs about teaching and learning directly affect how and why we teach the way we do.” Throughout my teaching career, I have tried to remain true to my personal philosophies about teaching, which align with the learner-centered constructivist approach. One of my priorities has been to implement a balanced literacy method. I emphasize all dimensions of literacy: reading, writing, speaking, listening, and viewing, to create a comprehensive learning environment. My responsibility is to guide my students as they develop into proficient readers, writers, thinkers, problem-solvers, and self-evaluators (Routman, 2000). Part of this guidance involves scaffolding instruction. Through modeling, I provide explicit instruction in response to my students’ needs so that my students can then learn through practice, hypothesis, and discovery (Routman, 2000).

I strongly believe that inquiry is the heart of authentic curriculum and learning. Therefore, I encourage my students to ask questions, explore, collaborate, research, think
critically, problem solve, and clarify. I try very hard to create opportunities for my students to engage in meaningful, real world learning experiences so that they are fully prepared to succeed in the real world. The research design that I have created for my self-study is consistent with my personal beliefs related to teaching and learning.

**Context of the Study**

As I indicated above, my students will play an important role in my study, as I would not be able to conduct my research without their cooperation. Throughout the science and writing unit, all nineteen of my third graders will be present for all model lessons and investigations. My class is comprised of fifteen females and fourteen males all between the ages of eight and nine years old. Of these nineteen students, twelve are white, four are African-American, and three are Hispanic. All of my students speak English as their first language. Two of my students, one female and one male speak some Spanish at home, but are not yet fluent. Seven of my students receive free or reduced meals at school. My students receive a wide range of services based upon need and ability. One male student has an Individualized Education Plan and receives daily one-on-one instruction from the special education teacher. The teacher pushes in four days a week for either reading or math and the student is pulled out for resource time five days per week. Two students, one female and one male work with the speech teacher two days per week. Additionally, four students, three females and one male receive five, thirty-minute sessions of Academic Instructional Support (AIS) per week. These students, with the exception of one of the females and the addition of one other female student, also work with the AIS teacher for math two days per week for thirty minutes at
a time. Four additional students, two boys and two girls, leave the room during free time
two days per week for math enrichment. Three of these students, plus another female
also attend science enrichment during Friday recess.

Over the past six years, I have worked hard to develop a classroom environment
that supports a variety of learning situations: whole group and small group lessons, one-
on-one instruction, group work, and independent learning activities. I will complete my
study, in its entirety, within my classroom.

At the front of my spacious, third grade classroom is the whiteboard, which I use
to display the daily schedule, date, homework assignments, reminders, and classroom
jobs. Directly to the right is the classroom library with books, magazines, and articles
sorted by genres and reading levels. Earlier in the year, my students and I developed a
system of labeling so students could be easily find a book and return it to its proper place.
This corner of the room also houses a literacy bulletin board and my easel and rocking
chair, which is where I teach mini lessons. In the middle of the room are clusters of
desks. Twenty desks are arranged in four groups of five, which encourages discussion
and collaboration. My students will often separate their desks, or form their own
“offices,” in order to create independent work areas. Tucked away in the back corner of
the room is my desk and computer, which I use only before and after school and during
my planning time. At the back of the room are a row of six computers intended for
research and educational games and programs. Over the computers, along the entire back
wall of my classroom is a large bulletin board, divided into four smaller sections. The
middle two sections have been devoted to science and writing, displaying anchor charts
from model lessons, student created rubrics, vocabulary, and student work. The students
and I often refer to the bulletin boards as they are important resources of information. Adjacent to my desk is the science center. This area holds tools intended for investigations, ongoing experiments, and science notebooks when not in use. A few of my students have contributed to this corner by bringing in research they have conducted at home. This includes Ethan’s collection of photographs of both prehistoric and modern sharks, John’s growing list of facts about venomous snakes, and the book about polar bears authored by Madison. Crates of books related to math sit on the windowsill along the side of the classroom. This area also contains a bookshelf with reading material related to water, our current topic of study. Beyond the bookshelf is an area for supplies, such as crayons, markers, scissors, highlighters, clipboards, extra pencils, and erasers. These items, like others found in the room, are easily accessible to students. Two rectangular tables are set up on opposite sides of the room so that distractions can be limited while learning takes place.

**Data Collection**

Throughout the course of my self-study, I will keep a research journal. On each day of the study, I will create a journal entry that includes a description of that day’s science writing lesson. In addition to the description, I will reflect upon my experiences. I intend to examine my development as a teacher implementing the Common Core Standards for expository writing, my practice teaching through an interdisciplinary framework, my desire to help my students develop as thinkers, writers, inquirers, my need to provide more authentic feedback, my growth as a researcher, my aspiration to
support my reluctant writers, and my students’ interactions, questions, and engagement in activities as well as their academic progress in science and writing.

**Data Analysis**

The data collection process yields a great deal of data for analysis. Through intensive and systematic analysis of my research journal both during and after the implementation of my study, I will uncover answers to my research question. One way in which I will carefully analyze my reflections is by sorting data into categories based upon my research sub questions:

- How do I develop as a researcher and a teacher implementing the Common Core Standards for expository writing?
- How do I learn to teach through an interdisciplinary framework?
- How can I support my students develop as thinkers, writers, inquirers, even those who are reluctant?
- How can I provide more authentic feedback?

Highlighting and color coding data in my research journal related to each question will encourage me to develop a deeper understanding of my work as an educator and teacher researcher. In addition to categorizing my data, I will also order data chronologically. This will help me to see my development, and the development of my students over time. Finally, I will collaborate with my thesis advisor and critical friend to speak about my research. Communicating with individuals will help me confirm or reject analyses, focus data, and cultivate clarity in my findings.

**Procedures**

Over the course of five academic weeks, I will implement my research study. I will utilize writing class time to model procedural, descriptive, and explanatory writing,
all forms of expository text and provide time for students to engage in these various forms of expository writing. The writing lessons will coincide with an inquiry-based science unit about water. The content of the expository writing lessons will relate to science investigations. My students will utilize science notebooks to record their learning about science concepts while simultaneously developing their expository writing skills. After teaching my students about the elements of a science notebook entry, my students will practice procedural, descriptive, and explanatory writing through these elements.

An additional critical step in the design of my study is to provide students with feedback on their writing. I anticipate that the use of offer verbal feedback to my students in regard to the various forms of their expository writing. The outline below provides a week-by-week schedule of my research design.

**Week One**

I will begin my study by presenting my students with photographs depicting scientists of all levels and in various fields. These photographs will highlight that scientists are also writers. My students will then have the opportunity to view scientists’ science notebooks. This will lead into my first model lesson. As I engaged in an investigation that explores surface tension as a property of water, I will model how to create an exemplar science notebook entry that includes a table of contents, a research question, my prediction supported with evidence, the procedure, findings, which will include scientific drawings, tables or graphs, and a conclusion. My entry will be used as an anchor chart and will be displayed in the room.
After my students produce the skeleton of their own science notebook, they will engage in an investigation to examine how water interacts with three materials. They will practice incorporating all the elements of a science notebook during their research as I circulate around the room providing individuals with feedback. After completion of this investigation, I will collect the notebooks to read through their work to provide additional feedback on sticky-notes the following day. My students will also have exposure to the science notebook rubric I created. As a class, we will analyze the rubric and refer back to my model lesson to determine expectations. With this information, I will guide my students through another investigation that involves building thermometers to see how water contracts as it cools and expands as it is heated. Again, I will provide my science writers with individual feedback in order to help them include the required elements in their entry.

The next day, I will provide my students with scored rubrics along with my comments regarding what they did well and how they might improve upon their next science notebook entry. In addition, my students will also have a space on the rubric to comment on what they did well and to set a goal for their next entry.

The next portion of my study will include another model lesson, this time related to procedural writing. Using a previous investigation, I will demonstrate how to sequence detailed steps of the procedure. This model entry will serve as another anchor chart. As a class, my students will use my exemplar to generate a rubric that pertains to procedural writing. This rubric will be used to guide students as they write the procedure for future investigations.
**Week Two**

I will begin week two with a review of the rubric created for procedural writing. As students engage in an experiment to learn about density, they will continue to practice creating science notebook entries with all of the important features. The students will pair up with a fellow scientist to ensure their procedure section meets the requirements established on the rubric. I will collect my students’ notebooks on this day so that I can score their procedure using the rubric and provide feedback the following day. I plan to confer with my students so that they can make revisions to their work. This process of investigating scientific concepts, generating notebook entries, conferring with students, and opportunities to revise will continue to take place over the next day two days.

On the final day of the week, I will present yet another model lesson, this time related to descriptive writing. During this lesson, I will utilize the investigation from the previous day to describe my findings. Using sensory details to elaborate on main ideas and creating scientific drawings, charts or graphs within the findings section of my entry will be my focus.

**Week Three**

Throughout the third week, my scientists will focus on descriptive writing. After reviewing my model from the previous week, my students will collaborate to generate a rubric that highlights the important aspects of descriptive nonfiction. I will facilitate this activity to ensure that my students recognize that sensory language or vivid language, elaboration, scientific drawings, charts or graphs, and conventions are essential components of descriptive writing.
The unit will continue with an investigation centered on the concept of evaporation. Scientists will discover that evaporation is the process by which liquid water changes into water vapor. At the completion of this experiment, I will use the class-generated rubric as I confer with students to provide feedback and offer support as writers make necessary revisions. I will continue to meet with students individually to assist them with the writing process as they engage in an investigation that explores the effect of air temperature on evaporation.

**Week Four**

I will encourage my students to focus heavily on descriptive writing throughout the first half of the fourth week. As a class, we will review the important aspects of descriptive writing that should appear in the findings section of their science notebooks: sensory details, elaboration, scientific drawing, charts or graphs, and proper conventions. Students will study the effect of surface area on the rate of evaporation and create their notebook entries, applying their new knowledge related to descriptive writing.

On Wednesday, after I have had an opportunity to read their work and fill out a second rubric pertaining to descriptive writing, I will confer with my students. Again, I will offer praise and provide suggestions on ways students may improve their work. I will assist students in revising their writing in order to promote the development of proficient writers of descriptive text.

The following day, I will utilize the conclusion portion of the surface area investigation to present my final model lesson on explanatory writing. I will demonstrate how my research, gathered from multiple sources, and my observations can be used as
evidence to support a claim. Furthermore, I will highlight the importance of conveying my ideas and information clearly in order to successfully explain the scientific concept. Later that day, I will guide my students as they generate yet another rubric illustrating the important aspects of explanatory writing: claims and evidence, factual information, clear and accurate ideas, and proper conventions.

After providing my students with time to review the typed rubric, my students will begin another investigation on condensation, which will involve examining the relationship between surface area and the rate of evaporation.

**Week Five**

The fifth and final week of the unit of study on water will begin by completing the condensation investigation. My students may also make revisions suggested on my sticky note. Now that my students have studied both evaporation and condensation, I will introduce the water cycle. At the end of the school day, I will collect my students’ notebooks so that they can be returned the following day along with a completed explanatory rubric.

In order to support my students as they work to improve their writing, I will meet with them for individual conferences. Later that day, my scientists will be asked to collect a small sample of water from home to return to school in order to study the properties of water that affect its quality. As part of this investigation, they will compare the samples and evaporate the water to find out if any contain dissolved materials. They will also consider the different types of water used for different purposes.
Later in the week they will again hand in their notebook for feedback related to their conclusions section. Again, I will create an opportunity to meet with students individually to discuss their strengths and suggestions for improvement as well as to assist with revisions.

The final investigation will involve discovering how flowing water is used to do work. Working in teams, students will develop and implement a plan to construct a waterwheel. They will use water to power their waterwheel and lift and object.

At the completion of the investigation, students will turn in their science notebooks so that I can score their work according to the science notebook rubric. My students will compare this rubric to the one they received at the beginning of the unit to evaluate their progress as scientists, writers and thinkers.

**Criteria for Trustworthiness**

Throughout my experience conducting this self-study, I anticipate that I will collaborate with three individuals for assistance with the evolution of my study. Samaras (2011) states that collaboration with others is an essential factor in the transformation as a teacher researcher. On a weekly basis, I will communicate with my thesis advisor either via email or a phone conversation. I will also collaborate with a critical friend, within a separate professional field, a minimum of two times per week. In addition, I will interact with a colleague at least three times per week to discuss my research. Maintaining an open line of communication between these individuals and myself will help me to expand my thinking to improve the overall design of my study. As a result of their encouragement, I will be able to enhance the clarity and cohesion of my research.
In order to successfully analyze data, it is critical that I employ effective, qualitative methods for gathering data and understanding my practice as an educator (LaBoskey, 2004). Through the use of observations and a research journal, I will have the ability to clearly and accurately record descriptions of each lesson and reflections of the lessons. Each day immediately following the school day for five consecutive academic weeks, I will generate journal entries consisting of the description of the lesson, activity or investigation that took place that day. I will also reflect upon my experiences in regards to my development of a teacher teaching expository writing to the Common Core Standards my practice with the integration of science and writing, my ability to foster thinking, writing, and inquiry skills, my desire to provide more meaningful, authentic feedback, my development as a researcher, and my hope to support struggling learners.

In order to uncover the answers to my research questions, it is essential that I reread my journal entries on a daily basis. Reviewing my entries will encourage me to make new discoveries and develop new knowledge (LaBoskey, 2004). Furthermore, continuously revisiting my research questions throughout my study and learning from my analysis, will help me achieve my ultimate goal, refining my teaching skills so that I can create exceptional learning experiences for my students (Samaras, 2011).

Laboskey (2004) asserts that self-study researchers interact with a variety of texts. As I work on the various chapters of my study, I will continue to read professional literature suggested by my thesis advisor to ensure that I am well informed in regards to research, literacy, and the art of teaching (Samaras, 2011).
Limitations of the Study

Although my research was carefully prepared, I am aware of its unavoidable limitations and shortcomings. One of the major limitations of my study was the five-week time frame in which I had to complete my research. During a typical week, my students have writing daily and science on Wednesday and Thursday. On Monday and Tuesday, my students travel next door for social studies with Mrs. Miller, our team teacher. While she works with my students, I provide science instruction to her class. In keeping with this schedule, I would not have been able to complete my study until early June. Therefore, I consulted with Mrs. Miller to develop a plan for keeping our own students for a full five weeks so that I could implement my study within adequate parameters. We decided that the five weeks could not be extended for two reasons. The first reason was based on grading purposes. Each marking period is ten weeks, which meant the quarter would need to be divided equally among science and social studies. After my students’ five consecutive weeks in science, they would spend the remainder of the marking quarter, Monday through Thursday, in social studies class with Mrs. McNair. The second reason for not extending my study was my role in training and scoring for the state ELA test. Just before I was about to begin my integrated unit of study, one of my administrators approached me about attending a training related ELA test scoring. My participation would also involve training other teachers within my district and scoring the ELA test after it had been administered. Due to my knowledge regarding these responsibilities, but not having specific dates scheduled for training and scoring, I decided that it would be in my best interest to plan my self-study so that it would not
interfere with these events. However, I am aware that conducting my study over a longer period of time would have yielded different results.

Other factors that will a significant role in the results of my study are the demographics and discourses of my third grade students. If another teacher research was to duplicate my research design, she may need to make necessary modifications to meet the needs of her students. Therefore, my results may not be generalized to other third grade classrooms.

**Summary**

Through this self-study, I anticipate seeking answers to my research question: How can I use science notebooks as a tool to teach expository writing? I intend to explore this question over the course of five academic weeks in my third grade classroom as I integrate science and writing. I will model procedural, descriptive, and explanatory writing, all forms of expository text so that my students can utilize science notebooks to record their learning about science concepts while simultaneously developing their expository writing skills. Throughout the process of interdisciplinary instruction, I will provide my students with feedback in the form of sticky notes and rubrics, and one-on-one conferences. I will document my discoveries and wondering in a research journal so that I can examine the following questions:

*How do I develop as a researcher and a teacher implementing the Common Core Standards?*
*How do I learn to teach through an interdisciplinary framework?*
*How can I support my students develop as thinkers, writers, inquirers, even those who are reluctant?*
*How can I provide more authentic feedback?*
My research design is consistent with my personal beliefs related to teaching. Throughout my study, I will adhere to a balanced literacy approach, I will scaffold instruction, and I will emphasize inquiry-based learning. In addition, I will collaborate with my thesis advisor and my critical friend for guidance in the progression of my study.

Although there will be limitations such as the five week time frame in which my study is being implemented and student demographics and discourses, I anticipate that analyzing my data will enable me to work toward my goal of refining my teaching skills in order to provide authentic, meaningful learning experiences for my students.
Day 1
Modeling Science Notebook Entries and Surface Tension

Lesson Summary
Today marked the first day of my study and the first day of the inquiry-based science unit on water. My objective was to demonstrate how to create a science notebook entry that included a research question, a prediction, procedure, findings, scientific drawings, charts, and a conclusion.

I began the lesson by showing the class a slideshow. The first two slides depicted scientists of all ages, exploring, discovering and WRITING!
The last three slides revealed samples of scientists’ (professional and nonprofessional) lab books.
This led to a conversation about the elements of a science notebook. My students noticed that the entries listed the date, the procedure of the investigation, scientific drawings with labels, mathematical equations, and findings. I asked my nineteen students to join me on the rug in the library corner for my model lessons. I sat next to my easel with my students surrounding me.

I announced, “I’m going to show you how to create a science notebook entry, just like you saw the scientists doing in the photographs!” I then modeled how to use a science notebook to show my thinking: “I’m wondering how many drops of water I can fit on
“this penny,” I told my students. After dating the page, I recorded my research question: How many drops of water will fit on a penny?

My students began to interject answers, so I reminded them that they were listening to my thought process. My intention was for this lesson was to model how to create a science notebook entry. “I’m thinking I can fit 2 or 3 drops of water on the penny because the size of the penny is small. Did you notice how I supported my claim with evidence?” On the following line, I recorded my prediction. “When I wrote my prediction, I made sure to include my evidence.”

I then shared, “The next section of my notebook entry is the procedure.” I wrote this new heading under my prediction. “I will sequence the steps of my investigation. It is important that the steps are in the correct order so that my friends can easily follow my directions to create the experiment on their own. I proceeded to record the procedure.

As I set out to investigate how many drops I could fit on the penny, I created a new heading labeled findings. “I think it makes sense to organize my data, or information, in a chart. After charting my initial findings, I discussed the importance of keeping variables constant to increase the validity of my results. “I’m thinking I need to repeat the procedure two more times to be certain I obtain a consistent outcome.”

As I worked, I stopped several times to record detailed observations in the findings section.

Next, I demonstrated how to create a scientific drawing of how the bead of water formed a dome shape on the penny.

After three trials Ethan said, “The other side of the penny looks and feels different.”

I repeated the procedure three additional times controlling variables, recording detailed observations in my findings section, and charting my data.

“Hmmm…on both sides of the penny, the water formed a dome shape. This makes me wonder why and how this happens. I’m going to look into this!”

I then drew a line across my paper to show my line of learning (LOL). “LOL means that at this stage of the investigation I will provide you with information about the topic and you will gather research via the Internet, texts, or an expert on the subject.”
Reflection

What went well?
Based on their reactions, comments, and level of engagement, I believe my scientists were intrigued by the lab book samples they viewed in my presentation. “Oh man, that’s cool!” Ethan exclaimed when he saw the scientific drawing in the first notebook entry. When Brayden saw the drawing of the bridge in the second entry he shouted, “Let’s make that!” They really seemed to understand the strong connection between science, literacy, and math. For example, Sarah noticed the scientists who generated the first notebook entry had incorporated a mathematical equation. John also noticed the scientists had taken measurements in inches.

I did not intentionally incorporate an example with mathematical computations, but I am thrilled it turned out that way. I think it is important for my students to understand the
interconnectedness of content areas. In this particular science unit, my students will be using a variety of tools for measurement.

In an attempt to make the concept that scientists document their thinking in a science notebook more believable, I explained that Mr. Summers keeps a lab book as part of his work as an optical engineer. Mr. Summers is my fiancé and they ask about him no fewer than 20 times per day so I knew they would be enthralled by this information.

Although I was unable to bring one of his science notebooks to school due to confidentiality reasons, I explained that he uses his lab book to effectively organize his data and to record discoveries that inform future investigations.

After the lesson, I hung my science notebook entry on one of bulletin boards so that it could serve as an anchor chart for the students as they develop their entries. I’m certain my students and I will refer back to it throughout the unit.

What was challenging?
Out of excitement, my students began to get a bit chatty. They needed a few reminders to raise their hands and wait to be called on. At one point, I stopped the lesson and I told my students they had one minute to share their thoughts about science notebooks with a neighbor. Due to time restraints, there just wasn’t enough time for everyone to express their thoughts to the entire class.

What I would do different next time?
This lesson has had a major impact on my students’ attitudes and motivation toward writing in science. Next year I will be certain to present the PowerPoint presentation early on in the school year.

What I noticed about individual students?
Overall, my scientists seem very excited to begin using their new science notebooks, which is interesting because they never showed much interest in their notebooks before. I’m especially anxious to see how my students who struggle with writing use their notebooks.

Day 2
Water on a Surface

Lesson Summary
During writing today my scientists decorated their science notebooks, which are simply twelve sheets of lined paper stapled together. I handed out a blank table of contents page that they could glue onto the second page. “We will list all of our investigations on the table of contents page. You will also record the page number for each investigation. The table of contents will make it easier for you, as well as others, to locate investigations in the notebook,” I explained.
Later in the day, we began our next science investigation, looking at water. I briefly discussed that water is an earth material, a substance that makes up or comes from the earth. The students shared what they knew about water, how it is used, and where it is found. “I know that we need water to live. We can’t drink salt water though” Alan contributed to the conversation. “I use water for drinking, showering, filling my fish tank, swimming, and making soup,” Diane added. “There’s lots of water in Lake Ontario and at Niagara Falls too,” said Ben.

One student connected to the previous investigation, commenting on the dome shape the water made on the penny. “Do you think water makes a dome on all surfaces?” I questioned. My students began to all talk at once. “What do you say we find out? Open up your science notebooks to page two. My students opened their notebooks to record the research question, “Does water form a dome on all surfaces?”

I reminded them to write a prediction and to support it with evidence. We referred back to the anchor chart to ensure everyone was setting up the notebook entries in the same manner. “I think the water won’t make a dome on all surfaces because some surfaces are flat, like the penny, but other surfaces are wavy,” one student suggested.

I challenged my scientists to put their predictions to the test. “Use a dropper to place individual drops of water on the three different surfaces: aluminum foil, wax paper, and paper towel,” I directed. I emphasized the importance of careful observations. As students worked with the first material, aluminum foil, they recorded the step-by-step procedure.

Before moving on to the next surface, I asked students to record their findings. Beckett reminded the class that it would be helpful to also include a scientific drawing. My scientists repeated the same process for the wax paper and the paper towel.
At this point in the investigation, I stopped students to emphasize the importance of keeping information organized, saying, “Remember, you need to be able to read your research. Others may want to read your research as well. Remember how I organized my information under headings? It’s ok to leave space between the procedure and the findings in case you want to add more steps.”

As students were working, I moved about the room so I could monitor the progress of each group. Students were eager to share discoveries after which I would respond, “WOW! Did you remember to include what you just said in your notebook? Remember, scientists record all of their thinking!”

After students had 25 minutes to explore, we came back together as a class to discuss the findings. “The water looks like Jell-O on the wax paper. It wiggles when you bump the tray,” “Did the water look like Jell-O on the aluminum foil?” I probed. “The water just spreads out on aluminum foil. It doesn’t make a bead.” “How about on the paper towel? What did you observe?” “The water was a bead and then it sank in,” exclaimed Diane. “You’re telling me the water soaked into the paper towel? Great observations!” I declared.

At this point, I asked my students to draw the LOL, line of learning. I affirmed the students’ findings and introduced the word absorb to describe what happened to the water on the paper towel. The children used the computers to do some research to determine why water beaded up on the wax paper and not on the other surfaces. We used Google to seek answers and recorded our new knowledge on post-it notes.

4.8: Students Conducting Research Related to the Investigation

The students shared their information with each other and then proceeded to write their conclusion statement. “Make sure you share what you learned from both our
investigation and your research! You learned a new vocabulary word you can include as well” I reminded students as I pointed to the words absorb.

4.9: Beckett’s Science Notebook Entry for Water on a Surface Investigation

**Reflection**

**What went well?** I was really impressed with my students’ scientific drawings. A few students realized it would be beneficial to create their drawings from multiple perspectives…great thinking!
Coincidentally, today’s math lesson involved using tables to identify number patterns. I was thrilled when Alan pointed out that I had created a table the previous day to record
the number of drops I was able to place on the heads and tails for three consecutive trials. Another student, Sarah, also pointed out that our non-fiction text features poster also displayed a table. The students are already generalizing what they have learned to other subject areas. I’ll be interested to learn other skills that my students transfer.

**What was challenging?**
I noticed that all of the students were very engaged in today’s investigation, in fact, they were so engaged they were forgetting to write in their science notebooks. When I overheard students engaging in rich discussion related to the investigation, I reminded them to write down their thoughts. “Scientists always record down their thoughts!”

A few of my students kept asking, “What do I write?” “Let’s look at my sample,” I remind them. The anchor chart I created during day one has already proven to be an extremely helpful visual.

**What I would do differently next time?**
I did focus on keeping the sections of my notebook organized and in sequential order during my model lesson. However, a few of my students were writing things all over the page, which made it very difficult for me as well as the writer to read. I think this was because they were going back and forth between the procedure and the findings for each surface. I decided it would be best to momentarily stop the investigation so that we could all go back to review how I had organized my entry. This definitely proved to be helpful, but we’ll see if they are more systematic in future investigations. I will be certain to put more of an emphasis on the importance of organizing information as part of my next model lesson.

**What I noticed about individual students?**
As I moved about the room I noticed that Brayden, Beckett, and Jane had finished testing the water on the surfaces that I provided and were observing water on other surfaces such as their hands, the tray, the rug, and the cup. I overheard them using our new vocabulary. “It’s surface tension!” shouted Jane. “What do you mean? I asked. “The water is making a bead [on my hand] like the it did on the penny.” Brayden pointed to a bead of water he had dropped on his tray, “surface tension!” “Awww, the water absorbed into the rug. I can’t see it,” said Beckett. “I’m making my dome bigger,” Brayden said as he went about adding more drops of water to his bead. Together, we watched the bead grow in size. “Think about other places you have seen surface tension,” I prompted. I left the scientists to discuss their connections as I moved on to observe another group.

**Day 3**
**Building a Thermometer**

**Lesson Summary**
Last night I analyzed my students’ notebook entries. I placed sticky notes in each scientist’s notebook that included a positive comment as well as a suggestion. I was looking specifically at whether or not students included all of the elements of the science
notebook. When I handed back the notebooks during writing, I gave students a few minutes to read and reflect on my feedback.

I also handed out the science notebook rubric I had created, which we dissected as a class. We reviewed my exemplar and the students justified why my sample would be awarded a four in each category. I made my scientists aware that the four in each category explained the expectations for notebook entries, but I assured them that I would help them throughout the unit so that by the end they would be experts in scientific writing.
During science, the students began an investigation to explore what happens to water when it is heated and cooled. After recording the research question along with their predictions, the students poured green, room temperature water into a small glass bottle. Next, they placed a clear straw through a rubber stopper and inserted the stopper into the opening of the bottle until the water settled halfway up the straw. They then placed this equipment into a cup of hot water to observe the water expand up the straw. After a few minutes, students placed the bottle in a cup of cool water. The water quickly contracted and moved down the straw. The students and I stopped to discuss and record the procedure of the investigation. They recorded their findings, along with scientific drawings into their science notebooks. As students were working in small groups, I moved about the room to confer with individual students.

The students were very curious to learn why the water rose up and down the straw so they used turned to books to seek answers. After about twenty minutes, the students returned to the rug to share their ideas. At this point, I introduced vocabulary: expand, contract, and thermometer, and we discussed the concept that when water is heated it expands and when water is cooled it contracts. The students examined thermometers, using body heat to cause the mercury to rise, to better understand this idea. I encouraged them, “Try to use the new vocabulary words in your explanation of what you learned today. Be sure to write what you learned under the heading, conclusion.”

**Reflection**

**What went well?**
My students really seem to be enjoying the hands-on investigations. All of my students, especially those who are somewhat reluctant such as, Brayden and Diane, are taking an active role in the investigation process.

I am already noticing my development as a teacher researcher. With everything we are expected to do this year, I often feel rushed. However, I am feeling more relaxed because I am focusing on two subjects simultaneously, and as a result, I am spending more time observing my students. Our science/writing time passes in the blink of an eye. The last two days when I told my students it was time to get ready to go home, my students responded with “Awwww, already Miss Deiboldt?” “Wait! Can we have five more minutes?” and “Can we take this stuff home to do?”

**What was challenging?**
It seems as though my students who struggle with writing shut down when I presented the science notebook rubric. I suspect that even my model from yesterday was probably overwhelming for them. “I don’t expect you to write like this,” I reassured them. “We are going to spend a good chunk of time learning to write in science.” I really want all of my students to be confident, competent writers. I’m going to make sure that I confer with those who struggle during each investigation. I anticipate that one-on-one conferences will also be necessary on a weekly basis to ensure they develop stamina and confidence as writers and scientific thinkers.

**What I would do differently next time?**
I’m wondering what I can do differently to generate a more positive reaction to the rubric. By some of my students’ facial expressions, I could tell they were overwhelmed by the expectations. Perhaps I can make a copy of a student’s notebook from this year to show my next year’s students. I could show one of the first entries of the notebook as well as one of the last to show my class how much progress they can each make if they are persistent and conscientious.

**What I noticed about individual students?**
During the investigation, Brayden announced, “It’s like the temperature!” I asked him to elaborate on his comment and he explained that the water moving up and down the straw reminded him of the thermometer in the classroom window. “What a great connection! I’m so glad you shared your thinking with us, Brayden!” I replied. I noticed that he was beaming! It’s not too often that Brayden volunteers so I think he was pleased that he wanted to share and the other students were very supportive of his contribution. I pulled him aside later that day and said, “I want to thank you again for sharing your thinking with us today, Brayden! Oh, do you mind if I share your conclusion section with Mrs. Pillar (the AIS teacher)? She’ll be so impressed when she sees that you used our new vocabulary to explain what you learned today.” “Ok,” he said with a smile. I wanted him to know that his ideas are important and valued. I’m anxious to see if he continues to contribute throughout the unit of study.
Day 4
Providing Feedback and Modeling Procedural Writing

Lesson Summary
After the investigation yesterday I evaluated my students’ science notebook entries. I completed a science notebook rubric for each student so that I could share my feedback today during class. “Do you think Omar was the star the football team his very first day of practice? I said when I saw the expressions on my students’ faces. “As long as you work hard, you will be terrific scientists, writers, and thinkers by the end of our unit. During one on one conferences, I talked with each student about what he/she had done. I also asked students also pinpointed an area of focus for future investigations on the rubric page.

Next, I informed my students that today we would focus on writing a clear and accurate procedure. As I sat at the easel, the students gathered around me on the rug. Sitting before us were the tools from the thermometer investigation. I started by writing a heading: Procedure, and then I began to reenact the investigation, recording my detailed steps as I went along. I explained, “Before I continue on with my investigation, I need to write down what I just did. If I, or someone else, wants to repeat the investigation, I’ll have my step by step directions.”

The students helped me select appropriate transition words to use at the beginning of each step. I demonstrated rereading my work to ensure that each step included enough detail, all of the steps were organized sequentially, and I used proper conventions. I told them that I could use carrots (^) to make additions if I needed to. The next phase of the mini lesson involved having a student follow my directions. I explained, “Sometimes we think we have included everything we are supposed to, but you can ask one of your classmates to review your work. He or she can offer helpful advice in terms of important information that may be confusing or missing from your procedure.”
Later that day, students had the opportunity to meet with a classmate for a peer conference. Students worked to improve the procedure section of the investigation of their choice. I also met with a select few of the students who struggle with writing, to guide them in developing their procedure section.

Reflection

What went well?
Overall, I was very pleased with my science notebook entries. They did very well with recording their investigations in the table of contents and including clear and accurate scientific drawings and tables.

It was interesting to read the students’ comments regarding what they did well and their goals for the next few notebook entries. I’ll have to make sure I address these areas when I meet with them in conferences to support them in working toward their goals.

Although I was modeling procedural writing, I did invite students to join in the writing process. They helped me enhance the piece by offering more details that should be included within the steps of the investigation. “We should use finally instead of last because we’re not in second grade anymore,” commented Allison. “Don’t forget to say that the green water was room temperature water. There’s a difference,” added Diane. Allison also reminded me to mention that we pushed on the stopper until the water rose halfway up the straw. I responded, “I’m so glad you’re giving me all these great suggestions, boy and girls! I like that you’re giving specific information.”

What was challenging?
What proved to be more difficult was the organization and scientific accuracy of students’ research explanations. However, this being the beginning of my study, I am confident that this will improve because of my expository writing mini lessons.

**What I might do differently next time?**
One thing I really emphasized was the importance of going back to reread my work. I want my students to do this in any situation when they’re writing. Often times, my students will hand in work that is missing words or entire sentences, which can greatly affect the meaning of the text. I modeled how I reread my writing at least five times during my lesson to ensure I included transitions for each sentence, my steps were in sequential order and included enough detail for another individual to repeat, and my conventions were correct. It could be particularly powerful for those students who struggle with writing because rereading means seeing the work again and deciding what can be done to make it better.

With this said, I would like to revise the science notebook entry rubric to include something about rereading work to improve sentence fluency. I think it would make sense to include this under the conventions category. I don’t think it’s too late to do this. I plan asking for my students’ input, and I think they will be open to this idea.

**What I noticed about individual students?**
During my conference with Beckett, I said, “Beckett, I really like how you labeled your sections [pointing to the various sections in his notebooks]. The headings make it very easy to read what you did and what you were thinking and discovering. I’m wondering. What were your observations during the investigation?” Beckett began to share what he noticed. “Did you write that down somewhere?” I asked. He searched his entry with no luck. “That’s really important information. Do you think during our next investigation you might record what you noticed in a findings section?” I asked. “Yeah. I can do that!” Beckett said eagerly. I’ll be sure to check in with Beckett during the next investigation to see if he remembers to record his findings. He was very much engaged in the investigation. So much so that I think that he forgot to write down his findings. I think that during the next investigation, I’ll place him in a group with more self-motivated writers. Perhaps this will encourage him to do more writing.
Diane, a writer who struggles, helped enhance my procedural writing by suggesting transition words from the writing bulletin board. I’ve noticed that she’s doing really well with selecting relevant transitions in her own writing.

**Day 5**

**Generating a Rubric for Procedural Writing**

**Lesson Summary**

During writing time, the students and I collaborated to create the rubric for procedural writing. I began the lesson by sharing my procedural writing model from yesterday. The students took turns rereading my writing sample. I instructed them to determine the aspects that were important for them to include in their own procedural writing. They decided upon four categories: transition words, detailed steps, sequence of steps, and conventions. They then developed a three-point scale for each category (3 = amazing!, 2 = good job!, 1 = try again!) They also established the criteria. I typed the rubric and let everyone review it for approval.
4.17: Student Generated Procedural Writing Rubric

Reflection

What went well?
I haven’t had my students create a rubric since the beginning of the school year. I wish I hadn’t waited so long to do it again, because they were really engaged during the process. We worked together to ensure that everyone’s ideas were included in one way or another.

What was challenging?
A few of my students were so excited they kept shouting things out so I had to stop in the middle of the lesson to remind them that I absolutely loved their participation, but it’s important to let everyone’s voice be heard. No one’s ideas were excluded.

What I might do differently next time?
I really hope that by having the students create the rubric, they are intrinsically motivated to reach the expectations they set for themselves. I’m also hoping that all of my students, particularly those who struggle as writers, have a more concrete understanding of what is expected, and how to attain the agreed upon benchmarks. I will continue to reflect upon this lesson throughout the unit to determine if there is anything I should change about this lesson.

What I noticed about individual students?
During the first part of the lesson, Brayden was fairly quiet. I wanted him to be involved in the process so I kept asking him questions such as, “Do you agree with what Sarah is saying? Why do you think it is important to have all of our steps in order?” Brayden’s
responses were limited to yes or no. I wanted Brayden to feel involved in the process, but I also wanted him to know that his contributions were valued.

**Day 6**

**Sinking and Floating Water**

**Lesson Summary**

We reviewed the procedural writing rubric the students created yesterday. “You decided on the important features of procedural writing. We all agreed that these are the expectations for procedural writing.” As we conduct our investigation today, we will include all of these aspects into our procedure section. You may keep the rubric at your table to serve as a reminder.” I said.

The first part of the day’s investigation involved exploring floating and sinking objects. The students first examined the objects and record predictions with evidence. Then, they placed the objects in water to determine whether or not their predictions were correct. They also included their results on the chart. This raised the question, “Why do some objects sink while others float?” The students were not just focused on the small objects they placed in the bucket of water; one question on everyone’s mind was “How can ships float if they’re so heavy?” They developed and recorded their predictions in their science notebooks.

As students placed small vials of red, hot water in room temperature water, we stopped to discuss and record our procedure.

The students carefully reread their work and the work of their neighbors to check against the rubric. When the students placed blue, ice water in the vial, inside the cup of room
temperature water, we repeated the same process to ensure that their writing aligned to the expectations on the rubric.

4.19: Sarah’s Procedural Writing for Sinking and Floating Water Investigation

The students discovered that the hot water floated to the top of the room temperature water and the cold water stayed in the vial at the bottom of cup. My scientists were able to connect with floating hot water and the sinking cold water to the objects from the first part of the investigation, but did not yet have an answer to their research question. They used texts, the Internet and an online encyclopedia to obtain additional information.
They used post-its to record information that they then brought back to share with the group. My scientists were able to identify density as a factor in whether things sink or float. With a bit of explicit instruction, they were able to explain their learning in their science notebooks.

Reflection

What went well?
They were all very much engaged and excited to talk about the investigation. Many did very well recording detailed steps of the investigation in sequential order, which is why I decided to pair these students with those who were struggling.

What was challenging?
It certainly was a struggle getting some students to write today. As I listened to them engage in conversation about the investigation, I asked, “Did you write that down? Could you add that to your procedure? Scientists are also writers!” Another challenge was getting the students to include important vocabulary. A few kept referring to the water as red or blue instead of red, hot water or ice cold, blue water. I offered some advice and suggestions, such as, “You said the steps should be clear, specific, and include important vocabulary. Let’s look at our vocabulary list again. Are you remembering to use these words in your procedure?” Despite reviewing the list, not all students included the words in their procedure section.

What I would do differently next time?
I think engaging in another shared writing lesson would have helped increase the students’ understanding and use of procedural writing. I would spend more time emphasizing the importance of producing specific steps that include important vocabulary.

What I noticed about individual students?
I was particularly impressed with how Diane and Lindsay worked together. I overhead Lindsay ask Diane, “What did you do next? Ok, write that down. Then what? You could write that down, too. Good job, Diane! What did you do last?” Lindsay’s prompts and praise encouraged Diane to reread and revise her writing. I was sure to let Lindsay know how critical and helpful her feedback was to Diane’s progress as a writer.

Day 7
Providing Feedback and Revising Procedural Writing

Lesson Summary
Today during writing we focused entirely on procedural writing. Last night I assessed the students’ understanding and use of procedural writing. I filled out a rubric based on student’s procedure section from yesterday’s investigation related to density.
4.20: Student’s Procedural Writing Feedback

During individual student conferences, I shared the completed rubrics. I began each conference by sharing something that the student did well such as including relevant transition words or successfully sequencing steps from the investigation. Next, I identified a focus area, often asking “I’m wondering if you could make your steps more clear and specific by adding more detail.” They were open to this suggestion so together we worked to elaborate on steps or incorporate important vocabulary, among other things. Throughout the process, I had them reread their writing several times both aloud and silently as a way to identify areas they thought additional revisions were necessary, and also to understand the cohesion of their writing. After I met with all students, several students shared their writing with the class. The readers’ classmates offered compliments and asked questions, for example, Could you explain how you made the slope steep? as a form of providing the readers with feedback.

Reflection

What went well?
I believe my students did well using transition words sequencing steps within their procedure section. They were also very open to making revisions to their work.

What was challenging?
Through evaluating my students’ work, I noticed the two areas of difficulty were proving adequate detail and using proper conventions. I will continue to emphasize these elements of procedural writing in future lessons.

Also, I noticed that it can be challenging for students to make revisions to the entries in their science notebooks. My students have been instructed to only write on the front of each page in their writer’s notebooks. This allows us to cut and paste sections of notebook pages during conferences to improve organization and restructure their writing.
They are unable to do this with science notebooks because the entry continues on to other parts of the page.

**What I would do differently next time?**
I will continue to emphasize all of the elements of procedural writing, specifically, the use of detailed steps and proper conventions. Perhaps next time I will have the students engage in peer conferences after they have received their rubric, but before I meet with them for a one-on-one conference. I think this could benefit all writers because they might have a better understanding of what they did well and what needs to be improved upon based on the feedback from their peer.) Perhaps it would also be helpful to revisit the exemplar I created during my model lesson to show my students how I reread my work and made insertions to improve my piece.

**What I noticed about individual students?**
As I worked with Diane today during her conference, she was full of questions such as, “What do you call that thing that we put hot and cold water in?” and “What kind of water was in the big cup?” I prompted Diane to look at our word wall to find the word that described the water (room temperature). I told her that I hope she remembers to consult the word wall as she continues to write in her science notebook. I have struggled all year to get Diane to take advantage of environmental print.

Beckett was also full of questions! He was connecting what he had learned from the investigation about sinking and floating to real world situations, asking questions such as “What about alligators? Sometimes they float in the water and sometimes they go underwater? How come they don’t stay at the top or just stay at the bottom?” I told Beckett I thought his questions were intriguing. “Let’s take a look at your procedure for the investigation. When we’re finished, you can do some research on the computer regarding your questions about alligators.” He happily agreed and we got to work on his writing. Beckett scored a two for his detailed steps, and I told him his writing was difficult to read. “I’m wondering what you wrote down that I missed because I had trouble reading your writing.” Sure enough, when I asked Beckett to read me his writing, he found it to be equally as challenging. “Why do you think it’s important to use neat handwriting?” I asked. “So people can read it,” he responded. “That’s right. I would hate for anyone to not be able to read your wonderful thinking because they can’t read your handwriting!” I told him.

**Day 8**
**Water on a Slope**

**Lesson Summary**
During writing today my students and I reviewed the rubric for procedural writing. I had the students share the expectations they had set for each category according to the rubric. Then, I had two students, who had done particularly well on their procedure section, share their writing. Since I asked these two students to share ahead of time, I had photocopied their work and displayed it on the overhead projector. As they read their work to the class, we stopped to pinpoint the elements from the rubric in their writing.
For example, we highlight the transition words, circled important vocabulary, numbered steps to ensure they were properly sequenced, and checked for conventions. I reminded everyone to apply these skills as they wrote their procedure during today’s investigation.

The science investigation, water on a slope, involved placing drops of water on a sloped surface to observe the flow of water downhill. To pique their interest, I drew a picture of two hills, one steep and one gradual. I asked the students to identify the hill they would prefer to sled down. They chose the steeper slope because the speed at which they would move down the hill would be greater. I asked them to test this hypothesis during the investigation. We recorded the following research question in our science notebooks: “How can water flow faster?” The students recorded their predictions, connecting to the sledding conversation.

Before setting up the investigation, I asked the students how we could use a tray, covered in wax paper, and other materials in our classroom to create a slope, or a slanted surface. The scientists developed a plan for each group of three students to place a large dictionary under one end of the tray. I informed them that this slope could be identified as a gradual surface. Diane reminded her classmates that they should be writing down each step that we had just taken as part of the investigation in our procedure section. Another student also mentioned the importance of including the term gradual slope.

After providing time to record the procedure, each group used a small cup of water and a dropper to place drops of water at the top of the slope.
RQ: How can water flow faster?

P: It can go faster when it goes straight then down like a waterfall because waterfall have fast moving water.

Procedure: First, we get a blue tray or wax paper. Next, we make a flat surface with the wax paper on the tray. Next, we get a cup of cold water with a dropper in it. Then, we got a dictionary and made a gradual slope. After that, we kept adding water to a dome and it goes down the gradual slope really fast. Then, when you put one dome on the wax paper it stays. When you put more water on the dome it has more water to put it down the gradual slope. Then, we got a not book to make it steep. Then, we move the book in front of it and put 2 paper boxes on the dictionary in front of it. Finally, we dropped water on the steep slope didn’t stay it won’t down fast.
The Scientists found that a drop of water can move very slowly or not at all down the gradual slope. The beads, however, did move down the slope faster when they were combined. The students documented these findings in their science notebooks.

Next, the students placed another dictionary under their blue trays, and I explained that now the gradual slope had become a steep slope. Again, they placed drops of water at the top of the slope, this time discovering that a single bead of water move much faster down the steep slope than the gradual slope and that the bigger the bead, the faster it flowed down the slope. The students also included these findings in their notebook under the Findings section.

4.22: Investigation: Water on a Slope

The scientists had an opportunity to discuss their findings and returned to their seats to answer the research question (How can I increase the flow of water?) based upon their new discoveries. They labeled this section Conclusions.

**Reflections**

**What went well?**
I think reviewing samples of procedural writing and having visuals on the overhead was helpful for all students (especially my visual learners). I believe that Alan and Lindsay were proud to share their work with the class and their classmates were quick to provide compliments.

I was pleased that Diane reminded her classmates to document each step of the procedures in their science notebook and that Nate encouraged the class to include important vocabulary.

It was interesting to see how the scientists problem solved regarding how to position the dictionary under the tray. It took several attempts for them to determine that the best position was laying the book flat. They discovered that positioning the book vertically made for a very rickety structure.

**What was challenging?**
My students are still getting used to the routine of exploring and writing during investigations. I found one group was having difficulty writing because one student would record information while another would take over the dropper to explore and flow of water. The student who began writing then became distracted and wanted to watch what the other student was doing. In an attempt to solve this problem, I had each student manipulate the dropper for one minute. After each scientist had a turn, I told everyone to leave the dropper in the cup of water so everyone could write without interruptions. What began as a challenge ended up working out nicely as they all did well recording their findings and creating scientific drawings.

**What I would do differently next time?**
Although some scientists effectively and efficiently documented their findings while other team members explored, I think that it is important for scientists to observe other scientists during investigations. Carefully observing what others do during investigations can lead to new discoveries and new ways of thinking. For example, as each student in the group previously mentioned took a turn, he or she approached the task a bit differently. One student placed only small drops of water very close to the wax paper. The next student held the dropper higher and squeezed more water at a time onto the wax paper. The next student combined what he had seen his follow scientists do and placed both small and large drops of water on the top of the slope. I wish I had pointed this out to the rest of the class. In future investigations, I will be certain to highlight the importance of observing how others engaged in investigations because this could lead us to discover interesting findings and help us generate additional questions.

**What I noticed about individual students?**
After Lindsay shared her procedures with the class, Beckett told Lindsay that he liked that he could easily read her work. Yes! I can see that he’s thinking about what we discussed during our conference yesterday.

Brayden got a sled for Christmas, and sledding is one of his favorite winter activities so he was very engaged in conversation, which is why I was surprised to see that for his predication he wrote, “Water plow (flow) faster because I saw it in a Lake.” I prompted him to verbalize this experience. I was curious to learn about his prior knowledge. Perhaps he had seen a river or steam flow into Lake Ontario. I knew that he had just moved into an apartment that backs up to the Canal, too. Unfortunately, our conversation was cut short by a phone call from the office that requested he gather he belongings to leave early.

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**Day 9**

**Providing Feedback and Revising Procedural Writing**

**Lesson Summary**
During writing today we continued our focus on procedural writing. I evaluated their progress as procedural writers filling out a rubric based on student’s procedure section
from yesterday’s investigation related to water on a slope. During individual student conferences, I shared both of the completed rubrics so that the students could see the progress they had made in such a short amount of time. I placed the rubrics side by side so they could recognize a category or categories in which they had improved, referring back to their notebook entry to pinpoint their development.

Next, using the feedback on their rubrics, I had students identify a focus area, or an area in need of improvement. If students received a score of three for each category, I guided them in selecting an area of continuous focus such as refining the elaboration or clarity of each step. I encouraged them to reread their writing several times both aloud and silently as we worked to enhance their writing. Students returned to their seats to continue working on making improvements to their writing. Three writers shared their procedure section at the end of the class, and like before, their peers offered compliments and asked questions to provide the reader with feedback.

Reflection

What went well?
I am pleased with the progress the students are making with their procedural writing. All have improved from the last procedural writing assessment. I had Sarah share her piece because she had incorporated fractions to describe the amount of water she had in her cup as part of the investigation. We revisited the notion that scientists are readers, writers, thinkers, and mathematicians all at the same time!

What was challenging?
Making revisions in science notebooks proved to be a bit challenging for the students. In writers’ notebooks, students cut apart sentence or paragraphs to reorganize information and to make additions. Doing this would destroy the integrity of the notebook entry, so we did the best we could erasing and using carrots (^) to enhance the writing piece.

What I would do differently next time?
I think it would be helpful to meet with students who found the procedural writing task challenging first. That way, the students would receive specific strategy intervention, have adequate time to work on additional revisions individually, and could meet with me a second time to monitor their progress and to provide any additional feedback that could foster better understanding of the writing skill.

What I noticed about individual students?
Diane has made significant improvement in her oral language skills since the beginning of the school year. She often experiences difficulty clearly expressing her thoughts and ideas because she has not yet developed a rich vocabulary. Today during her conference, I noticed that she was using new vocabulary she had learned from water investigations. I said, “You are doing such a great job using new vocabulary. How would you feel about using that vocabulary in your procedure to add more detail?” She agreed that this was a good idea. We worked together to construct fluent sentences that included important vocabulary. For example, we restructured, “Then, we get the water and in the water it
has a draper (dropper).” into “Then, we got a cup of water and a dropper. After that, we used the dropper to put beads of water at the top of the gradual slope.”

I noticed Sarah incorporated her new knowledge related to fractions in her Procedures section. She wrote, “I also got ¼ of a cup of water.” Good for her! I’m happy to see this transfer and application of knowledge.

Day 10
Modeling Descriptive Writing

Lesson Summary
Today during writing I modeled descriptive writing. I informed the students that they were already practicing descriptive writing as part of procedural writing by describing the process of their investigations. I told them that we would continue to work on writing clear procedures, but now we would add another focus, clearly describing our findings. I shared, “If you want readers to clearly understand what you’re trying to communicate, which is your goal, you need to be a successful descriptive writer”
I gathered students on the rug as I sat at the easel so that I could explicitly model how to create an exemplary descriptive writing piece. I had all of the tools from the previous investigation, water on a slope, available, and I had one student read her procedure section from her notebooks so that I could recreate the inquiry. Once I placed drops of water at the top of the gradual slope, I got right to work describing my findings. I demonstrated the importance of using relevant and vivid language and carefully selecting important vocabulary to help the reader clearly understand my discoveries. My lesson also highlighted the importance of making scientific drawings accurate and large enough so that the labels could be read without any confusion. I repeated this writing process for the water on the steep slope, again, emphasizing details on main ideas, incorporating important vocabulary, and the creation of accurate scientific drawings. At the end of the lesson, I reminded the students that during the next investigation, they would practice descriptive writing.

Reflection
What went well?
My entire lesson was executed within a twenty-minute time frame. I’m anxious to see how my modeling impacts my students’ writing. I’m confident that students will approach descriptive writing with a positive attitude based on their comments. “That’s it?” asked Diane. “Easy peasy!” said another student.

What was challenging?
In order for students to develop as both procedural and descriptive writers, they will also need to develop as thinkers because both forms of expository writing focus on producing clear, specific, and detailed ideas.

**What I would do differently next time?**
Next time, I will invite a student or two to come up to participate in the investigation to emphasize the idea that findings can descend from the interaction with others. Observing my students during this investigation and reading professional literature has made me realize that collaboration is an important aspect of discovery.

In order to make the concept of procedural writing more authentic and meaningful, it will have students engage in and describe familiar procedures they follow such as getting ready for bed or to playing their favorite sport.

**What I noticed about individual students?**
I noticed that the overwhelming look on Diane’s face when I informed the students that we would learn about another form of expository writing. She hung her head and became preoccupied with her belt, trying to ignore my news. I reassured the class that we would do lots of practicing just like we had been doing with procedural writing, sharing, “I would never ask you to do something I didn’t think you could do well,” I said. “And remember, I am here to help you improve!” I’ll have to be sure to conscientiously praise and encourage Diane to help boost her confidence.

**Day 11**
*Generating a Rubric for Descriptive Writing and Evaporation*

**Lesson Summary**
When my class convened on the rug today, I informed them that they would create another rubric, this time one that depicted the expectations for descriptive writing in science. As we reviewed my descriptive writing model from the day before, they noted that I had relevant details to support my topic, my details were clear and accurate, and I included important words to help the readers understand my discoveries. They also recognized that I included scientific drawings that provided important, accurate information, I showed a strong command of conventions, and my handwriting was neat and easy to read. Based upon their feedback, we created four categories: elaboration, word choice, scientific drawing/charts/graphs, and conventions.

As before, my students decided that each category would be out of three (3 = amazing!, 2 = good job!, 1 = try again!). Next, we collaborated to determine the criteria for each score. I told them that I would type the rubric for them to view as soon as possible.
Later that day during science, I asked the students to look out the window, saying, “Remember that wintry mix we got early this morning? Everything was wet: the roads, the sidewalk, and the woodchips on the playground. I’m noticing that now everything is completely dry. Are you wondering how everything went from being wet to completely dry?”

I wrote the research question on the board, “What happens when water is exposed to air?” We discussed the meaning of the word exposed. Jimmy was wearing a t-shirt so we agreed that because his short did not have long sleeves, his arms were exposed to the air. I reminded the students that the wet pavement outside our window was exposed to the air, and I then encouraged them to write a prediction to the research question.

For the procedure of the investigation we placed a dry paper towel in each of our two clear, plastic cups. Using a syringe, we put 10 milliliters of water in each cup, making sure the paper towel absorbed the water. Then, we covered one of the cups with a dome lid and left the other cup uncovered, exposed to the air. We placed both cups on the windowsill, and I told my students (look at this again) we would wait one day for the findings.
Reflection

What went well?
I noticed that all of the students were engaged in the process of creating the rubric. I think their prior experience with developing and using a rubric helped make them feel more comfortable, despite the fact that the form of expository writing varied. Since they were eager to contribute, I instructed pairs of students to sit knee to knee to discuss ideas. Each group was given the opportunity to share thoughts and suggestions with the class. I noticed that two of my students were interrupted several times by their partner, so I used the timer to ensure that each partner had an equal amount of time to talk before any discussion took place.

What was challenging?
As students developed the criteria for the descriptive writing rubric, I provided more guidance than I did with procedural writing. Sarah highlighted the importance of scientific drawings, Gabby mentioned that I used details to describe my findings, and Diane noticed my use of new vocabulary. However, generating the criteria for some of these categories was challenging for the students. “What makes my scientific drawings so outstanding? What did I do well?” I asked to promote thinking. I was certain to
provide adequate wait time before having anyone share his or her thoughts. “Now tell me, what would be the opposite of this?” I asked pointing to the criteria for a three. We continued generating criteria for elaboration.

**What I would do differently next time?**
Since we conducted this investigation as a class, only a few students had the opportunity to manipulate the materials. In the future, I will have students work in small groups so that all students are able to gain experience with metric measurement. It was also difficult for everyone to see everything close up. Having students work in small groups would eliminate this problem.

**What I noticed about individual students?**
As the class was rereading my findings section, Beckett immediately noticed my legible handwriting. “Your writing is so easy to read, Miss Deiboldt!” “I’m so glad you noticed!” I said to Beckett. “I took my time so that everyone would be able to read my work. Have you been practicing neat handwriting in your science notebook?” He grinned and nodded his head feverishly. I gave him a high five because I was so pleased that he has been conscious of his handwriting.

Alan used the term elaboration to describe my use of details, offering. “I like how you said you put the water at the top of the gradual slope. If you didn’t write that we wouldn’t know where you put the water and which slope it was on.” Alan is one of my strong writers, but my descriptive writing lesson has reinforced the idea that including relevant details helps the author effectively communicate his/her message.

**Day 12**
**Evaporation**

**Lesson Summary**
The students were very excited today to find that the paper towel that was exposed to the air had dried out completely and the paper towel in the cup with the dome lid was sopping wet, just as before.
As a class, we reviewed the rubric that they had created for descriptive writing. “Write what you discovered about each cup,” I encouraged. As I circulated around the room, I assisted students by prompting them to include details that related to the topic, important vocabulary, and accurate scientific drawings.

findings: The paper towel with the dome lid did not dry up or exposure to the air although the paper towel without the dome lid was exposed to the air.
Next, I told the students that we now know what happens when water is exposed to air, but we did not yet know why this phenomenon happens. “Let’s do some research!” I exclaimed. The scientists divided themselves into pairs. While some groups used the Internet to conduct research, other groups used the texts on the science bookshelf.

When students found relevant information, they recorded their research on a sticky note, and a few scientists working at the computers printed information such as photographs with captions. After about twenty minutes, the class reconvened to discuss the information they had come across in their research. They determined that the water in cup without the dome lid was exposed to the air and had therefore evaporated. They also discovered that when evaporation occurs, liquid water turns into an invisible water vapor.
and goes up into the air. They used their information along with their findings from the investigation to write a conclusion, or explanation to the research question.

I said, “We placed our cups of water in only one location. What do you suppose would happen if we placed cups of water in various locations around the room?” This led to another investigation, “What effect does air temperature have on evaporation?” The students included this research question, along with a prediction in their science notebooks. Next, they used a measuring cup to place one cup of water in a clear, plastic cup. They labeled the cup was labeled A and drew a line to show the water level. They repeated this procedure three additional times so that the class had the same amount of water in all four cups. After that, the students decided on the location of each cup.

As a class, they discussed the importance of placing the cups in locations that they thought would vary in temperature. They placed Cup A on a section of the windowsill that gets plenty of sunlight. They placed the next cup, cup B, in the bathroom where it is dark unless the bathroom light was on. They placed Cup C on a table near the side of the classroom, and they placed Cup D on the windowsill, but in a shady spot. A thermometer was also placed next to each cup to distinguish the air temperature at each location for four consecutive academic days.

About an hour later, I asked four students to read the thermometer at their designated location to report the air temperature. Then, students recorded the temperatures on a chart under findings in their science notebook. I informed students that we would repeat this procedure over the course of three more days, and I reminded them to include this step in their Procedures section.

Reflection

What went well?
I have noticed that students are refining their research skills. They are regularly using the text features (headings, table of contents, photographs with captions, diagrams, and fact boxes, among other things) to navigate, document and comprehend text. For example, when Brayden and his partner were using World Book Encyclopedia at the computer to conduct their research, they typed in evaporation in the search bar. When an article about the water cycle appeared on the screen, they immediately used the bold face print to find information specific about evaporation. I observed Diane and her partner using the table of contents to find information about evaporation in a book. “Look at this, Miss Deiboldt,” said Diane, motioning me toward her. She was pointing to a diagram of evaporation. “What?” I ask curiously. Diane proceeded to read the caption describing the diagram. Then, in her own words, she explained her interpretation of the process. It took a while for her to clearly express her thinking, but she did it!

What was challenging?
I noticed that Beckett and his partner were not very productive researchers. “What have you discovered so far?” I asked the boys when I caught a glimpse of them goofing off at the computer. “We’re still looking,” said Beckett. “I’m anxious to see what you find,” I
responded with a raised brow. “Keep in mind, there are lots of other scientists who would love to use the computer right now. I’ll be back in three minutes,” I said. As I wandered to the other side of the room, I noticed that the boys were flipping back and forth between websites, not lingering long enough on one site to read more than a few words. I walked back over to their computer. “Gentleman, did you notice what a great job Sarah and Bethany are doing over here? Look! They’re already writing on the back of their sticky notes!” I pointed to their empty sticky notes. I sent them back to their seats to do research on their own and I said that I was disappointed because I had trusted them to work together. Perhaps I need to spend more time with the boys helping them develop Internet research skills. Strategies such as highlighting text and using text-read-aloud devices may aid in their motivation and success as researchers.

**What I would do differently next time?**

I think it would be interesting to place cups of water for the evaporation location investigation in other areas of the building. Our college intern, the special education teacher, the AIS teacher, the librarian, and special area teachers might be willing to partake in this investigation by assisting students with accurately reading the thermometer in each designated location. Just the other day, the gym teacher asked how he could help in addressing Common Core State Standards. This project has the potential to not only emphasize new learning standards but also to build community throughout the school.

Next time I will also have my students use various tools, such as graduated cylinders, measuring cups, and syringes, to measure one cup of water, which will reinforce the idea that one cup of water can be measure in multiple ways.

**What I noticed about individual students?**

While Ethan was researching at the computer, I noticed he utilized several strategies to comprehend the text. First, he read the text at a slower pace. He also repeated one particular sentence three times, and at the end of the paragraph he summarized the text in his own words. I didn’t want to interrupt Ethan or the rest of my students so I made a note to mention my observation during reading tomorrow.

When it came time for Beckett and his partner to write the conclusion section of the evaporation investigation, they struggled because they had no research to incorporate into their writing. While students were sharing their writing with other, Beckett looked as if he was going to cry because he had hardly anything to contribute. I pulled him aside and asked what he was thinking. “I wish I didn’t goof off,” he responded. “Why is that?” I asked. “Because I don’t have anything on my paper now.” “Oh, I noticed.” I said. “You always do such a great job when you work hard, don’t you?” I left the conversation at that because I could tell Becket regretted his mischievous behavior. Perhaps he could benefit from working with Ethan next time.

I noticed that Brayden was also a bit preoccupied today. Although he had a great start to his findings section [the cup with a Dome Lide had a moist paper towel], he never began his conclusion section. I was working with other students so unfortunately; I did
not have the chance to work with Brayden individually. This makes me wonder, did he not understand the concept or was he just distracted? Is he confused about how to go about writing the conclusion? His sticky note did not appear in his science notebook when I collected it, so perhaps he lost it even before he was prompted to explain his thinking. When I asked him about it during recess, he simply said, “I don’t know.” Hmmm…

Day 13
Providing Feedback/Revising Descriptive Writing & Evaporation

Lesson Summary
Yesterday I collected my students’ science notebooks so that I could read their findings related to the evaporation investigation. I completed a descriptive writing rubric for each student’s work.

As I met with half of the students during individual student conferences, I began by sharing what each student had done well, highlighting this in their notebook. Next, I addressed a focus area. For most students, this was elaborating on ideas. I encouraged each student to reread his or her writing several times both aloud and silently as we worked together to enhance the writing by providing additional vivid details or including important vocabulary. The students then returned to their seats to continue working on making improvements to their writing. As before, I asked three writers to share their findings section at the end of the class, and their peers offered compliments and asked questions to offer the reader additional feedback.

They continued the evaporation location investigation by reading and recording the air temperature at each of the four locations around the classroom.

Reflection

What went well?
I’m glad I had the time to divide students into two groups as it is challenging to meet with all of them in just one day.

Most students produced a Findings section with outstanding detail. For example, Alan wrote, “The cup with exposed air didn’t have any more water on it like in the beginning. The cup with a dome lid on it still has a wet paper towel because it had no air exposed to it.” Another student wrote, “The paper towel in the cup without the dome lid is dry and crunchy [crunchy] as a leaf because it was exposed to air. The paper towel in the cup with the dome lid is very, very, very wet.
Three quarters of my students also included important vocabulary. For example, Alan correctly used the word exposed and in his Findings section and bubbled the words to indicate his application of the new words.

What was challenging?
I have noticed that my students’ scientific drawings have improved as a result of direct instruction related to descriptive writing. Their drawings provide more detail; however, some students are making their drawings much too small and as a result the information is difficult to interpret.

As I mentioned earlier, it is difficult for students to revise their writing due to the limited space on the paper.

What I would do differently next time?
In the future, I will begin my integrated writing and science unit earlier in the school year. As a result, I have will more time to devote to each form of expository writing, In addition, the unit of study will be extended so that investigations are not planned back to back. My students are making wonderful progress, but I can’t help but wonder how much more they would learn if the unit was not so compact. In addition, I will emphasize...
early on the importance of creating scientific drawings that reasonably proportioned and accurate.

**What I noticed about individual students?**
I am especially blown away with the progress Diane is making as a thinker and writer. She organized her findings section into two parts: one related to the cup with the paper towel exposed to air and the other related to the cup with the dome lid. She wrote: “I found that the cup with no top on it has no moisture in the paper towel. I found that the cup with a dome lid has a moist paper towel.” As a class, we never used the words moist or moisture. She either heard a classmate use these words or knew these words from another context. Either way, she is developing her tier two vocabulary.

4.31: Diane’s Descriptive Writing
Since my last conference with Beckett, he had been reminding the class to write legibly, which is why I was surprised when I saw his notebook entry. Not only were there lots of spelling errors (I have been emphasizing students to utilize environmental print along with the exemplars), there were no spaces between words. When I asked Beckett to read his work during the conference, he pointed to words, but made up ideas as he went along. “Is that what it really says?” I inquired. “Let’s try again.” This time, Beckett deciphered the first two words before giving up. “Beckett, if you cannot read your writing, how am I supposed to know what you’re writing? You’re such a great thinker, but this writing does not prove that. I sent him back to his seat to determine the rest of his message.

**Day 14**

**Providing Feedback/Revising Descriptive Writing and Evaporation**

**Lesson Summary**
Today’s agenda followed the same outline as yesterday except I met with the second half of the students for their individual conferences.

Just as the day before, scientists continued the evaporation location investigation by reading and recording the air temperature at each of the four locations around the classroom.

**Reflection**

**What went well?**
As I mentioned yesterday, the students are making considerable gains as descriptive writers. Lindsay said, “Think of it like this, what do we want the reader to know?” I loved that she was thinking about writing as a means of communicating. “In order to communicate information clearly, it is very important to include relevant and vivid
details in your writing.” One student added, “Or the reader will be like, huh? What? I don’t get it!”

**What was challenging?**
As we engaged in the investigation, Brayden did not complete his Findings section. When I thought I would have the opportunity to meet with him today, the AIS teacher asked to see him for testing. It’s important that I meet with him so that he can continue make progress as a writer of expository text.

The conferences went a little slower today than yesterday. Fortunately, the special education teacher entered the room at the perfect time to meet with a few students. I have been discussing my research study with her, as well as my expectation for descriptive writing. After a brief review of the rubric, I had her meet with two students to conduct their writing conferences.

**What I would do differently next time?**
I would like to have more time to spend on writing conferences for several reasons. For one, devoting more time to conferences would enhance students’ understanding of descriptive writing in science. I also believe that providing more individualized feedback would encourage students to develop as writers of any genre. Students would also be held responsible for taking an active role in their learning.

**What I noticed about individual students?**
Yesterday, I asked Beckett to return to his seat to decipher his findings section. He worked hard to decode his text and returned to the conference table with his work. “I think I know what I wrote,” he shared. You think or you know?” I questioned. “Wouldn’t it be better to know?” I reminded him that if he, or anyone else, is going to read his work, it has to be neat. “I want you to be proud of your work,” I reminded Beckett. I am hoping his takes this into consideration and decides to take his time when producing work.

Diane was beaming when she returned to my table from meeting with the special education teacher for a conference. “Wow!” exclaimed the teacher. “Diane is doing so much great thinking! I can tell she’s working really hard and having a great time writing about the science lessons!” When I think about the progress Diane has made in the last few weeks, I am excited to continue encouraging my students to write through science. We’re having so much fun!

**Day 15**
**Evaporation**

**Lesson Summary**
This was the fourth and final day of the evaporation location investigation. Students read and recorded the air temperature at each of the four locations. Next, I showed them how to find the average by adding the numbers to find a total and then dividing by four, the number of times we recorded the temperature for each location. Using calculators, they
worked in four groups to calculate the average temperature for each cup location. This data was shared and incorporated into the table in their science notebooks. Additionally, they measured the amount of water that remained in each cup and included this information in their table.

<table>
<thead>
<tr>
<th>Location of Cup</th>
<th>Air Temperature</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cup A Window</td>
<td>Day 1 69°F 70°F</td>
<td>69°F</td>
</tr>
<tr>
<td>Cup B Bathroom</td>
<td>Day 2 69°F 70°F</td>
<td>69°F</td>
</tr>
<tr>
<td>Cup C Teacher Desk</td>
<td>Day 3 69°F 69°F</td>
<td>69°F</td>
</tr>
<tr>
<td>Cup D Mailboxes</td>
<td>Day 4 68°F 68°F</td>
<td>68°F</td>
</tr>
</tbody>
</table>

4.3.3: Investigation: Evaporation Locations

To assist students in organization of their findings, I asked them to address each cup and how it compared in terms of the average temperature and the amount of water that evaporated to the other cups.

As the students were describing their findings, I met with five of the students who struggle with writing to guide them in developing their writing. I was confident that the students would produce better writing if they had the opportunity to verbalize the information before they wrote. While I was working one-on-one with a student, the others were sharing their observations aloud with a partner. I coached the students with a prompt such as, “Tell me about cup A. How did its average air temperature compare to the other cups?” After the students shared their observations I said, “Ok, Great observations! Now write what you just told your partner.” After a few minutes, I posed another question such as “How did the amount of evaporation in Cup A compare to the
other cups?” Again, the students discussed I then encouraged them to write their findings, referring to their data on the chart as necessary.

The students concluded that Cup A on the windowsill and Cup B (earlier you capitalized the c in Cup, please be consistent) in the bathroom had a higher rate of evaporation. These locations were also warmer than the other two locations. In order to make better sense of why this occurred, I had the scientists pair up to conduct research using Google.com and our science textbooks. As before, students recorded relevant information on a sticky note or printed information. After twenty minutes, the class came together to discuss their Internet and textbook research. They discovered that air temperature is one factor that influences evaporation. Evaporation will be faster if the air is hotter. The students used their information along with their findings from the investigation to write a conclusion, or explanation to the research question.

Reflection

What went well?

I strongly believe that science is a way to authentically teach some of the Common Core State Standards for math. Many of these standards can be addressed through an interdisciplinary framework. For example, my students were so interested in engaging in the science investigation, I don’t think they even realized they were learning math skills such as using a thermometer and calculating an average.

I also recognized my students’ persistence during this investigation. For example, as they were finding the average of the four temperatures, I heard students in three of the four groups talking about the importance of repeating the process to ensure they had reached the correct answer. How often does that happen during math class? Hardly ever! My assumption is that my students were not viewing this task as a math activity. Instead, they were interested in an investigation to learn about the world in which we live. My students were engaged in problem solving process to seek answers to a question in which they had a genuine interest. That’s what learning is all about!

My students are transferring the skills they are learning in science to the real world). Later in the day, one student said, “Miss Deiboldt, it’s 48 degrees Fahrenheit. It’s not cold enough to snow. Can we go outside for free time?”

What was challenging?

Working with the five students who struggle with writing was a bit challenging because they each work at a different pace; however, they did produce higher quality and more work than they would have if they were working independently. I realized that it was difficult for the students to compare the four water samples to one another, which is why I had them organize their information by reporting on one cup at a time. Within each description, I encouraged them to use superlatives (warm, warmer, warmest) to describe each location.

What I would do differently next time?
In the future, I will extend this investigation so students can observe the changes in the four cups over the course of two weeks or more. I noticed that the students were confused by the results of this investigation because the average temperatures were so close. We had to use decimals to determine the ranking. Lengthening the investigation or introducing decimals could take care of this issue. Connecting this lesson to decimals and money would help students, especially students who are struggling, make more sense of the findings. Also, it would be helpful to utilize the technique peer teaching so that students who struggle can receive support from students who are more advanced. The advanced students would also benefit from this activity because they would be reinforcing what they have learned related to the topic.

What I noticed about individual students?
As the students were discussing their findings, Ethan brought up an important point he had learned from his prior research. He shared, “I learned that heat makes water evaporate faster. Cup C and Cup D have lights over them so maybe that’s why they have less water in them.” I was also impressed when Lindsay mentioned that even though Cup A was on the windowsill, the weather had been gray and gloomy. “We thought Cup A would have the most evaporation. I bet if we did this in the summer it would have the most evaporation.” Lindsay was drawing a conclusion that during summer, Cup A would have the greatest amount of evaporation due to the heat from the hot sun. This dialogue proves that students are thinking outside the box!

Day 16
Surface Area

Lesson Summary
During writing this morning I reviewed the expectations for both procedural and descriptive writing with the students. We referred to the exemplars I created during the mini lessons and they took turns reading the examples and sharing what they noticed about the writing. Brayden noticed that procedural writing shows the steps in the right order. Alan also noted that each step starts with a transition. Eddy noted that everything should be spelled correctly. Aidan brought up the point that descriptive writing is like procedural writing because you have to have correct punctuation, capitalization, and grammar. Beckett grinned when Aidan said you have to write neat so people can read it. Ethan mentioned the importance of including clear details that support the writing topic. I asked my students what they could do to accomplish this goal? They decided that including descriptive words and scientific drawings could help the reader fully understand the writer’s message. “Please remember to include all of the elements of procedural and descriptive writing that we have discussed and practiced in your science notebook entry today,” I reminded my scientific writers.

To begin the science investigation, I showed students four containers, a graduated cylinder, a dome lid, a flat lid, and a 100 ml beaker. I asked them to compare the size of the opening of each container, and I explained that the area of water that is exposed to the air is its surface area. On the board, I wrote the research questions, “How does surface
area affect evaporation?” The students also recorded the question as well as a prediction in their science notebooks.

After I divided my students into five groups and collected their materials, the students used a syringe to fill each container with 25 ml of water.

I provided the students with approximately fifteen minutes to record their procedure. I also encouraged them to refer to their procedural rubric to ensure they were including all of the necessary elements of procedural writing. To organize their data, they filled out a table displaying the amount of water in each container at the start of the investigation. Students placed the four containers on a tray and were set on the windowsill and left undisturbed until the following day. The students were buzzing with excitement. “I think the dome lid will evaporate more because it’s bigger than the rest!” exclaimed Sarah to her team members. At this point, the students in Sarah’s group began exchanging ideas with some of the other groups, which I was pleased about because students were communicating like professional scientists would do.

Reflection

What went well?
As students were on the rug reviewing the expectations for procedural and descriptive writing, I noticed that they needed very little prompting. I believe that scaffolding instruction, involving students in the creation of rubrics, and providing immediate
feedback encouraged them to gain a clear understanding of learning objectives. Although procedural and descriptive are two different forms of writing, some of the expectations are the same. For example, Aidan and Eddy noted that for both types of writing, the author must use proper conventions and write legibly. These two traits carry over into any genre of writing.

Throughout the entire unit, my students have been encouraging each other to grow as writers, scientists, and communicators. Their support for one another is apparent through their language. For example when Diane was struggling to complete her procedure section, Lindsay took notice and prompted Diane to continue working by asking, “What did we just do? Diane verbalized the step and Lindsay would said, “Good job! You could write that down!”

I also observed Alan and Aidan sitting shoulder to shoulder. Aidan was reading his procedure to Alan. “Ooooh! That’s a good transition word!” Alan exclaimed.

**What was challenging?**
I’m glad that all of the students had the opportunity to measure the liquid using the syringe for this investigation. A few appeared to have a difficult time filling the syringe to the 25 ml line without getting air bubbles. This investigation provided students with additional practice with measurement.

**What I would do differently next time?**
I provided the scientists with a table to complete during the investigation. Next time, I would like my students to fill out some of the headings, which would provide them practice for generating tables in math. In an upcoming math unit, students are expected to create tables without my prompting to solve word problems.

**What I noticed about individual students?**
It’s always interesting to read my students’ predictions related to science investigations because they provide me with information regarding their background knowledge. As a result of my research on science notebooks, I have made a point to analyze their thinking in order to guide my instruction. The students had different ideas about how surface area affects the rate of evaporation.

For example, Beth wrote: “I predict yes because if one lid is the largest the water is just going to lay there but the 3 other one’s are like a cup so they [water] will rise up. And the dome lid will evaporate faster because the lid is wide.”

Beckett work: “The same amount of water will evaporate and turn into invisible clouds.”

Ethan wrote: “Maybe it doesn’t matter because I have done it before.”

Alan wrote: “The flat top will give out more evaporation than the smaller stuff because it is wider.”
Lindsay wrote: “I think surface area doesn’t have an effect of evaporation because it will evaporate at the same rate.”

I noticed that while Beckett, Ethan, and Lindsay believed that surface area does not play a role in the rate of evaporation, Beth and Alan have an inkling that as surface area increases so does the rate of evaporation. What I love about inquiry-based learning is that students are not right or wrong; students evolve as thinkers. My role is to act as a facilitator so that they can make their own discoveries about science.

During the first week of the unit, I discovered that as my students made discoveries and the class discussed results of the investigations, they were trying to erase and rewrite their predictions so that they were accurate. It took some time before my students realized that it is perfectly okay if a prediction was not accurate. I emphasized that it was important for them to check their prediction at the end of the investigation, saying “Checking your prediction allows you to realize misconceptions and new learning!” Ethan pointed out that he could analyze his notebook entries to compare his thinking about a topic both before and after the investigation. I told my students, we wouldn’t bother doing these investigations if they already knew all the answers. Scientists don’t care about being right or wrong before they investigate. What they really want is to make new discoveries! Their thinking changes in order to understand new ideas and concepts!

**Day 17**

**Surface Area**

**Lesson Summary**  
My scientists anxiously retrieved their trays to discover what had happened to the water in each of the containers. I told them to refer to the table they began filling out yesterday, and I asked them to read the table to determine what we would do next as part of our investigation. I inquired, “How are we going to determine how surface area affected evaporation?” After some brief discussion, they agreed that they would have to do some math. “We need to measure how much water is left in each container and then subtract the two numbers to find out how much water evaporated,” Sarah exclaimed.

“Let’s develop a plan,” I said, “Using the materials we have in front of us, how should we go about finding an accurate measure of how much water remains in each container?” Following some more thinking and discussion, they decided that the graduated cylinder would be used to find the most accurate measurement. After measuring the water in the graduated cylinder and recording the information the table, one student from each group dumped the water into a cup, and another student poured the water from the beaker into the graduated cylinder. Students recorded the data on the table. They repeated this process with the dome lid and flat lid.

Once students measured the water in all of the containers and documented, they got to work calculating the difference. Next, the students put the containers in order from the greatest amount of evaporation to the least. I asked them to compare the amount of evaporation to the water surface area in each container. By facilitating a class discussion,
they were able to explain that the flat lid, the container with the largest surface area had the highest rate of evaporation, and the graduated cylinder, the container with the smallest surface area had the slowest rate of evaporation. Students ranked the containers on the table.

I instructed students to write their Findings section based on the information they recorded on their chart as well as the discussion we had just had regarding surface area and the rate of evaporation. I reminded students to refer back to the descriptive so that they would remember to include the necessary elements of descriptive writing. Students pulled out their copy of the descriptive rubric to review individually or with neighbors.
After providing students with fifteen minutes to document their findings I asked three students to share their discoveries with the class. I noticed that as the students shared, the other students were adding information to their Findings section. I was ready to move on, but they asked for more time to write (I was ecstatic!). I observed how they were carefully reviewing their data and rereading their work. I sat with Brayden to provide him with writing prompts.
I then restated what the students had discovered about surface area and evaporation, prompting, “The greater the surface area, the higher rate of evaporation will occur. Why? Think back to previous investigations. Look through your research journal to see if you can come up with an explanation.” After a few minutes, Lindsay recognized that this investigation related to the other evaporation investigations, sharing, “We learned that light from the sun makes water evaporate. The light shines on the water and the temperature of the water evaporates!” I complimented Lindsay on her clear explanation, and I asked the students to then consider how that information played a role in the results of our investigation. I instructed them to develop their conclusion based on their findings from this investigation as well as the other evaporation investigations, class discussions, and the research that had done previously related to evaporation.

Reflection

What went well?
At the beginning of the school year, I remember doing problem-solving activities with my students and it was like pulling teeth! Students would groan, mumble, and complain! They were ready to give up so early on in the activity. Before we could complete the problem, students would have their heads down on their desk in defeat. While some of my students would avoid eye contact with me, others would leave their desk and head to the pencil sharpener or bathroom in an attempt to escape doing the work. What a transformation! My students were very eager to develop a successful measurement system. I believe that through the science investigations they have become better problem solvers because they can recognize that the first solution (what do you mean by immediate?) may not be the best solution. I see how the students have learned that problem solving requires a great deal of critical thinking. In order to problem solve, they have to make predictions, carefully observe, use trial and error, engage in rich discussion, and conducted research. I’m especially proud of how well they listen to one another to devise a plan.

What was challenging?
With nineteen students, I’m worried that not everyone’s voice was heard during the problem-solving activity. Not only is it important for me to hear everyone’s voice, it’s also important that students hear the voices of their peers.

What I would do differently next time?
Perhaps it would have been better to switch back and forth between small group work and whole class discussion in order for everyone to have a voice during the problem solving process. Having my students to work in small groups would allow everyone to collaborate and share ideas with one another. Furthermore, making time for group discussion between group work would perhaps encourage groups to modify their thinking over the course of the activity. Learning is social!

The next topic in math is surface area. I’m curious to see how the students’ background knowledge in surface area will enhance their understanding of the concept. I also hope
that the hands-on component will encourage my students who struggle to make connections and develop a stronger understanding.

What I noticed about individual students?
As students were measuring the water that remained in each container, Ethan pointed out that it was important that we are certain that all of the water was dumped before we measure the water in another container. He encouraged, “We better make sure we dump out all the water or else it will mess up our findings.” This shows that he is thinking back to our conversation about controlled variables during our very first investigation. When I asked Ethan to explain his thinking, she said, “We have to do everything the same way, just like real scientists. If they do things in a different way each time, the [results] will be different.”

Day 18
Providing Feedback and Revising Descriptive Writing

Lesson Summary
Yesterday completed a descriptive writing rubric for the surface area investigation so that I was prepared to confer with each student today. As in the previous conference, I began by sharing what the student had done well, providing evidence in his or her science notebook. I then addressed a focus area. For most students, this was elaborating on ideas. I encouraged students to reread their writing several times both aloud and silently as we worked together to enhance their writing by adding additional vivid details or including important vocabulary. After the conference, students returned to their seats to continue working on making improvements. At the end of class, I asked three writers to share their Findings section and their peers offered compliments and asked questions to provide each author with additional feedback. My students were very forthcoming with compliments as well as suggestions for writers. I applaud my students for offering feedback in such a polite and support way. Instead of say, “You should …” my students will say, “Do you think you could…?” I feel that this working encourages the writer to decide if and how they would like to revise their work.

The scientists continued the evaporation location investigation by reading and recording the air temperature at each of the four locations around the classroom.

Reflection

What went well?
I have noticed how my students are improving the clarity of their writing. In the beginning, they frequently used vague pronouns such as “it.” Now, they are incorporating more precise language and important vocabulary.

I have also noticed that they are developing a greater stamina for writing. Three weeks ago, I needed to prompt them to continue writing after only a few minutes. Now they are writing for an extended period of time with fewer prompts or words of encouragement.
from me. At the beginning of the school year, students would stop after five minutes to say they were done. Now, my students are writing for twenty minutes and asking for even more time. I strongly believe that they possess more persistent as well. They are motivated to writing during scientific investigations. With the exception of one, my students are generating notebook entries with proper guidance, but very little urging.

**What was challenging?**
It was challenging to meet with all of my students today because of an assembly. While I sat at the conference table, I had a student sit on either side of me so that while one student was making revisions, I could confer with the other student. It’s not as individualized as I would like, but I did what I could given the time restraints.

In a few situations, this double conference format might have been more effective because what I said to one student, the other student overhead. When I was speaking with Alan about elaboration, I saw Sarah rereading her work and adding adjectives.

**What I would do differently next time?**
In the future, I would like my students to conduct peer conferences on a weekly basis. I believe that by engaging in peer conferences, students progress as writers because in order to support one another, students need to have a clear understanding of the task and developing knowledge of writing traits and expectations. Peer conferences require students to play an active role in their progress as success as writers.

**What I noticed about individual students?**
I have noticed that Brayden always starts out with something right on target in his entry but then fizzles out or doesn’t finish at all. For example, his entry in the Findings section for the surface area investigation read, “I find out that the flat lid had the most evaporation. The dome lid had the second most evaporation.”

Brayden is currently taking medication for attention deficit disorder and the Academic Instructional Support (please write out the words) teacher and I are going through the final stages of the Response to Intervention process to ensure he receives the services we feel that he needs. What exactly does Brayden need to be successful? Does he need a quieter setting, limited distractions, and additional processing time? I have talked to the special education teacher about Brayden, and I have asked her to come in some time soon to observe him while I am teaching. I am hoping that she can provide me with some insight into strategies or technique I can implement to move him along the continuum of learning. Perhaps I could support Brayden as a writer by providing him with an individual word wall or a writing template to help him manage tasks into more manageable parts. I was intrigued by what Ethan had written in his Findings section, which involved his learning from the previous investigation. “I found out that the flat lid has the most evaporation because it was exposed to more light and heat from the sun and the lights in the classroom…” His response demonstrates his application and transfer of knowledge.
Beckett also revealed a transfer of new learning. When he sat down with me during his conference, he said, “So, Miss Deiboldt, the Atlantic Ocean will have a faster rate of evaporation than my pond because the ocean has a bigger surface area?” “What do you think based on your research?” I asked. He smiled at me indicating he knew his answer.

Day 19  
Modeling Explanatory Writing and Generating an Explanatory Writing Rubric

Lesson Summary
Today I modeled explanatory writing for my scientific writers, utilizing the Conclusions section of the surface area investigation. The students gathered around me on the rug as I sat in my rocking chair. I labeled my Conclusions section on a fresh piece of chart paper. I reminded the students of our process, sharing, “We have focused on procedural writing as well as descriptive writing. Both forms of expository text are used to communicate information. Today, I will demonstrate another form of expository writing, explanatory writing.” I then asked them what the word explanatory sounded like. “Explain!” said Sarah. “Yes, and we will use our Conclusion section to explain our learning.”

As a class, we briefly discussed yesterday’s investigation on surface area. The students referred to their science notebook entries to contribute to the conversation. We discussed the procedure, our findings, and our research.

“Boys and girls, look back at our research question [What effect does surface area have on evaporation?]. I will write my conclusion section to answer my research question, and I am going to begin by making a claim.”

I began writing my claim. “Now, I have to be sure I support this claim with evidence, and I have lots of evidence. I can use my observations, and I can use the information I discussed with my fellow scientists. This information will most likely be found in your findings section. Plus, I can use the research I collected throughout the unit of study.”

At this point, I produced my explanatory exemplar. I thought aloud as I worked. I emphasized reading my work and checking for proper conventions and elaborating on ideas to convey a clear message.
Later in the day during science, the students and I generated a rubric for explanatory writing using the same process we followed earlier. We reviewed my explanatory writing model from earlier in the day. The students noted that it began with a claim that answered my research question. Furthermore, my claim was supported with evidence that was gathered from multiple sources. I guided students to understand that my ideas were clear and precise. They recognized the importance of proper conventions and neat handwriting. Based upon their feedback, we created four categories: claim, evidence, word choice, and conventions.

The students decided that each category would be out of three (3 = amazing!, 2 = good job!, 1 = try again!). Next, we collaborated to determine the criteria for each score. I told them that I would type the rubric for them to view.
**Reflection**

**What went well?**
My students did really well with recognizing the important elements of explanatory writing. I think it’s very beneficial for students to not only recognize the features, but to have a name for each of these features as well. I realize now that naming the various aspects of each form of expository writing has been helpful during conferences. My feedback is more precise and meaningful.

I feel that the explanatory writing ties science notebook entries together. It’s important that students understand that they begin with a question about an idea or concept. Through the investigation, students problem solve to seek answers to this initial question. Therefore, their final section is intended to answer the question based on their new experience and new learning. This is the same process that professional scientists follow to make new discoveries, and therefore, students should also be expected to conduct these procedures.

**What was challenging?**
Two of my students found it challenging to remain in their personal space and stay focused, which created some distractions during the model lesson, but we got through it!
What I would do differently next time?
Next time, I think it would be beneficial to have a Findings section for the investigation that I could refer to during the model lesson. Perhaps my visual learners would more fully understand that the evidence in my conclusion section was derived from my findings.

As a third grade teacher, I have noticed that my students often struggle with identifying main ideas and supporting details. I’m wondering if practicing explanatory writing will promote the development of this skill. In order to reinforce the concept of main idea, I could create opportunities for students to help make this concept become more real to students. For example, I could ask students to describe how they spend their recess or what they did during gym class so that they could engage with the concept.

What I noticed about individual students?
Brayden was very distracted today. It was challenging for me to pique his interest during the lesson. He kept turning his body so that he was facing away from the easel. A knot in his shoelace was also the focus of his attention. During the creation of the rubric, he just couldn’t sit still. I asked him to go out into the hallway to do 25 jumping jacks. When he returned, he settled down a bit, but I could tell his mind wasn’t with the rest of us.

I’m predicting that my students will do well with explanatory writing, especially my students who have already conducted research on science related topics. “Guess what!” I said to my students at the end of the day. “Some of you are already learning how to write explanatory text. Quite a few of you have already shared information about snakes, cats or sharks. You were writing to explain your learning about those creatures. Did you elaborate on ideas?” I asked.

My students will have the opportunity to transfer their explanatory writing skills when they compile research for third grade country projects and animal projects and as they generate their own research papers for the next writing unit. I informed my students about these upcoming projects, and a few of my students have begun conducting research at home on their favorite animals.

Day 20
Condensation

Lesson Summary
I began today’s lesson with a review of the explanatory rubric, saying, “Remember, the Conclusion section is where you get to show off what you know! How does the conclusion relate to the research question?” I asked. Ethan mentioned that the conclusion section should answer the research question.
“How can I ensure I clearly answer the question?” I prompted. The students agreed that the scientific writers must support the claim with evidence. I asked, “Where can your evidence come from?” “You use what you learn from the investigation,” said Leslie. “You use your research,” added another student.

“We’ll practice this as we write our conclusion section tomorrow.” After discussing the aspects of explanatory writing, we began our next investigation around condensation. I mentioned that I had gone out for dinner last night and ordered a tall glass of iced tea. “What happens when the surface of an object, like my glass of iced tea, is cooler than the air surrounding it? I want you to see what I saw yesterday.” They then recorded the research question as well as a prediction.

During the procedure of the lesson, students placed green room-temperature water in a clear plastic cup. Students filled a second cup with blue ice water. After a few minutes, the students began to notice beads of water on the outside of the cup with ice water. In order to promote thinking, I said...

- How did water get on the outside of the cup?
  - At first, students predicted the water went through the cup somehow.
- Where did the water come from?
  - Ethan then mentioned that he thought the water was already in the air. “Remember how water evaporates and goes into the air?” he said.
- Did the water form on the outside of both cups?
  - “It’s only on the cup with ice water,” Diane noticed.
- Compare the color of the water on the outside of the cup and the inside of the cup
  - “Look! The water on the outside of the cup is clear!” Brayden shouted. “The water in the cup is blue though. How is it different?” he questioned.
- Breathe on the outside of the cup or other surface.
  - “It gets foggy,” said Beckett when he breathed on the cup of ice water.
    Student repeated this procedure on the cup of room temperature water and noticed no change.
- Wipe the surface dry and see if the water returns.
  - Students noticed the water returned shortly after wiping the cup.
The students then recorded their findings and created scientific drawings to depict the water that formed on the outside of the cup of ice water. Many students noted that they had seen this phenomenon before such as on the bathroom mirror or on the windshield of a car.
Reflection
What went well?
I noticed that the students were so intrigued with this investigation. They were curious to know where the condensation on the outside of the cup of ice water had come from. I find it interesting that even though they have witnessed condensation before, they never thought much about how it formed or why. I like that we are learning about concepts that students can directly relate to the real world.

In addition, I believe that they are learning to think on a deeper level about new and different concepts. They are developing an understanding that it’s certainly ok not to know everything from the start. I suspect that they are beginning to understand the idea that by making and testing out hypotheses, they can make sense of everyday occurrences in the world. They are not only more curious, they are also more adventurous in terms of how they approach new learning situations. In the past, many students appeared to be stumped when it came to making predictions. They would respond with, “I don’t know!” Now, they are making well-informed predictions based on background knowledge.
What was challenging?
About five of my students kept referring to the ice water and room temperature as either blue or green. Although it is important to note that the water is colored with food coloring, the more important idea is the temperature of the water. I have colored the water so that students can see, for example, that the water on the outside of the cup is not the ice water. Perhaps having the students measure the temperature of the water before dying it with food coloring would resolve this problem.

What I would do differently next time?
I would have loved for my students to have another 30-40 minutes observing and writing. Things were a bit rushed today so I’m curious to know what they were thinking had I had the opportunity to listen to them talking or read their writing. In the future I would devote more time to this investigation.

What I noticed about individual students?
I have noticed that Brayden is making very good process with his notebook entries. He is including scientific drawings of appropriate size that include clear labels. It may be challenging for Brayden to communicate through written form, but he is excelling with providing information through use of visuals. I believe that this is helping him build self-confidence.

Ethan is doing a great job of connecting learning by building on what he knows. For example, he remembered that when water evaporates, it turns into an invisible vapor. He suggested that when water appeared on the outside of the cup of ice water, it was possible that it was water vapor in the air. It is possible that such comments indicate that Ethan is making clear connections between investigations.

Day 21
Condensation and the Water Cycle

Lesson Summary
I begin today’s lesson by asking, “Who can summarize what we did during yesterday’s investigation?”

“We put blue ice water in a cup and water showed up on the outside [of the cup],” Diane said.

“Exactly! Do you remember what Ethan predicted?” Ethan repeated his prediction from yesterday, “I predicted the water on the cup was evaporated water. It was water vapor that was invisible in the air.”

At this point, students began to use the Internet and informational text to learn more about this concept. One group of researchers came up with the idea of googling the question: “Why does water form on the outside of a class of cold water?” This search results guided students to learn about condensation, which then led them to discover the water cycle. I could see that they were curious to know more about the water cycle so we
watched a youtube.com video I had previously selected to use for the lesson. During the second viewing, students used their bodies to act out evaporation, condensation, and precipitation.

When the class reconvened on the rug, I asked them to discuss their research. My students shared that the droplets of water on the outside of the cup came from the water vapor in the air. What the students saw on the cup was condensation. When water vapor touches a cool surface, it turns into a liquid. They also shared that condensation is one part of the water cycle.

The students generated their conclusion. I prompted them to begin with a claim that answered the research question. Next, I asked them to use their research as well as our discussion to provide evidence to back up their claim. “Are you remembering to include words that help explain your thinking?” I asked. “Are you remembering to reread your work to check for proper conventions?”

Condensation occurs when the gaseous water gets to a cold altitude. Condensation is the opposite of evaporation. When it is hot, water evaporates and turns into water vapor. Then, it condenses with means to form into a cloud. At that point, the cloud keeps getting more water. Then, the cloud gets heavy, and the water falls down. The cup was sweating because the air surrounding it is hotter than the water inside the cup. Next, the clouds can make rain, hail, snow, and sleet. This goes on and on. This is called the water cycle.
4.40: Student’s Explanatory Writing from Condensation Investigation

I then told students that they would work in groups to create a water cycle model to further observe evaporation, condensation, and precipitation. Inside clear plastic containers, students put a rock to represent a mountain, grass for vegetation, and a small pond made from aluminum foil and filled with water. They closed the containers and placed it on the windowsill to observe the process of evaporation and condensation, and precipitation.

4.41: Mini Water Cycle Models

“Throughout the next few weeks, you will use the models to observe the process of evaporation, condensation, and precipitation.” I informed my students.

Reflection

What went well?
I have noticed that with each investigation, the students are progressing in their skills as researchers. They have become accustomed to using text features to locate relevant information. They have also become more persistent (finish this thought). In the beginning, they appeared to become frustrated if they were unable to find relevant
information. Sometimes it was even a struggle to get some of them to even read the text. Now, they are more independent and self-motivated during the research process.

We had such a great time constructing the mini water cycle models. Brayden’s group even collected bugs for their ecosystem. I thought my students would have some difficulty understanding the abstract concepts of evaporation and condensation. I was pleasantly surprised. I believe their understanding will be enhanced even more when they observe the changes that take place in their water cycle models.

**What was challenging?**
I wish I had access to more computers. I currently have five computers that students can use for research. Students conduct research in pairs, and this can prove to be challenging when students want to watch a video like today because each computer has only one set of headphones. A few of my more introverted students prefer to work independently, which means they usually gravitate toward using the books. If I extend the unit, like I would like to do in the future, perhaps I can schedule blocks of time for students to conduct research. This would allow students to work independently or with a partner. My students might also have more time to research information if time slots were provided.

**What I would do differently next time?**
I did not have students create a notebook entry related to the water cycle model due to the lack of time. In the future, I will have them create scientific drawings to examine the changes that take place within their ecosystem.

My students really enjoyed exploring outdoors. I really need to find other ways of conducting science investigations outdoors in order to make learning more authentic and meaningful.

**What I noticed about individual students?**
I noticed that Brayden really shined during this investigation. When his group worked together to create the water cycle model, he stepped into a leadership role. “Ok, you want to get the dirt and grass? What job do you want?” he asked another teammate. “Let’s get it over here because the dirt is softer. We can dig it out easy,” Brayden added. His group members were enthusiastically following his suggestions.

I observed each group working well as a team. Every student was happy to partake in one aspect of the project or another. Diane has also stepped up into a leadership role at times. I believe utilizing science notebooks has helped in building her confidence. I think she sees herself on an even playing field with her best friend when it comes to doing science. I also strongly believe that when Diane has confidence in her ability, she will be more likely to take risks, which will result in greater success.
Day 22

Providing Feedback/Revising Explanatory Writing and Water from Home

Lesson Summary
At the start of today’s lesson, I share, “We have been using our conclusion section of our science notebooks to explain new learning clearly and accurately. I had a chance to review your writing after school, and I filled out a rubric, which I will share with you today during your writing conference.”

I met with students individually to provide feedback related to their conclusion section from a previous science investigation. I began each conference by complimenting the student on an area in which he or she had done well. In addition, I encouraged the student to identify an area of focus related to one of the categories from the rubric. I guided students in making revisions to their identified aspect of explanatory writing.

Students then shared their revised explanations with a partner who checked for the categories listed on the rubric.

During science class, I showed two samples of water, one clear and other murky. I asked students to identify the sample they would prefer for drinking water. I informed students that materials in the water affect quality. Water quality, or purity, determines how the water can be used. For example, materials mixed in water determine whether it is good to drink, suitable for washing clothes, or all right for irrigation. I asked, “So how materials in water affect water quality?” Students recorded their research question and made predictions in their notebooks.

As a class, we discussed and compiled a list of ways we use water in the school and home. I asked students which of the following types of water would be ok to use for each purpose they mentioned.

- Water from the canal
- Water from a swimming pool
- Seawater
- Dirty dishwasher
- Tap water

Students gave reasons for deciding which type of water was appropriate for each use.

I told students they would be responsible for bringing in a sample of water to observe and test (bath water, laundry water, canal water, pond water, etc.). I gave each student a clear vial with a removable label to take home. I directed the students to label the vial with their name and the source of the water. Students then began completing their Procedure section.

Reflection

What went well?
My students are doing better than I anticipated with the explanatory writing. I thought it would be challenging for students to use multiple sources to support claims, but they proved me wrong! This is very encouraging since our next writing unit requires students to write country and animal reports.

Since the beginning of the school year, we have been working on applying the claim and evidence approach. Perhaps this is why students are doing so well.

Sarah, for example, wrote:

Condensation happens when the surface of an object is cooler than the air surrounding it. I discovered this when we put ice cold water in a cup and fog got on the outside of the cup. I wiped it off with my finger and it came back. According to my research, the water got on the outside of the cup because the ice cold water in the cup made water vapor in the air turn back into water. The water had evaporated so it was invisible water vapor in the air. It’s like a cloud in the sky. The cloud forms because the very cold air makes the invisible water vapor appear and turn into the cloud.

Sarah demonstrates a clear understanding of the concept of evaporation. She makes a claim, supports it with her observations as well as her research, she incorporates precise language, and she has good control of conventions.

What was challenging?
While the majority of my students are generating effective explanatory text, my two writers who struggle are still having difficulty understanding how to structure and communicate through explanatory text.

What I would do differently next time?
It would have been helpful to spend an additional 5-10 minutes conferring with each student. In the future, I would like to confer with students multiple times on one section of their notebook before moving on to another investigation. In order to truly teach the writing process, students would meet with me at least three or four times for each writing piece. Instead of spending just one day revising and editing, it would be wonderful to spend an entire week improving students’ writing. As a result, I believe my students would become stronger writers of expository text. I also feel that students’ explanatory writing would be of higher caliber if they had a better understanding of the connections between and among the various types of expository text. For example, students are developing a deeper understanding of an idea or concept through the process of writing each form of expository text. I should emphasize this connection through my exemplars.

What I noticed about individual students
I have noticed that Brayden and Diane are struggling with providing relevant evidence to support their claims that answer the research question. Both students included observations from the investigation, but their observations did not explain or relate to the initial research question.
I would like to go over the model with these students again, and provide more individualized support so that they move toward internalizing the skills for writing explanatory text, not only for science, but for other content areas. Using examples from students’ everyday life would also be a way of making this idea more real for all students, especially for those who struggle.

**Day 23**

**Water from Home**

**Lesson Summary**

Today, students compared their samples to investigate how materials affect water quality. I asked students to organize their findings in a table in order to analyze water samples. Students observed the samples in small groups using hand lenses. The samples were passed around so that students could examine, compare observations, and then document the information in their table. They also engaged in discussion related to their findings.

4.42: Investigation: Water from Home
### 4.43: Students’ Table for Water from Home Investigation

When writing the conclusions section, I prompted students to answer the research question by stating a claim, and I encouraged students to support their claim with

<table>
<thead>
<tr>
<th>Source</th>
<th>Sample 1</th>
<th>Sample 2</th>
<th>Sample 3</th>
<th>Sample 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parking lot</td>
<td>in parking lot of little leapers</td>
<td>toilet water in house</td>
<td>shower water in house</td>
<td>fish tank water</td>
</tr>
<tr>
<td>Color</td>
<td>grayish brownish</td>
<td>clear</td>
<td>clear</td>
<td>clear</td>
</tr>
<tr>
<td>Clarity</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Odor</td>
<td>fish lake</td>
<td>pool</td>
<td>nothing</td>
<td>fish</td>
</tr>
<tr>
<td>Particles</td>
<td>rocks and dirt</td>
<td>none</td>
<td>none</td>
<td>none</td>
</tr>
<tr>
<td>Organisms</td>
<td>none</td>
<td>none</td>
<td>none</td>
<td>none</td>
</tr>
<tr>
<td>Other Observations</td>
<td>Pretty clear</td>
<td>Smells kind of good for toilet water are clear.</td>
<td>The toilet water and shower water are clear.</td>
<td>Clear for fish tank</td>
</tr>
</tbody>
</table>
evidence. “Remember to use precise language in your writing so a reader clearly understand what you learned. Also, good writers always reread their work to check for proper conventions,” I said.

Reflection

What went well?
This investigation encouraged and enabled students to practice and use a great deal of new vocabulary (source, clarity, odor, particles, and organisms). As I moved among the groups, I overheard students engaging in rich discussion and applying these new words.

“This is quite odiferous!” Ethan exclaimed when he took a sniff of one particular sample. “The odor is rotten garbage,” his teammate added. I believe that by giving students opportunities to engage in hands on exploration encouraged them to use new vocabulary in a meaningful context, they will be more likely to add the words to their repertoire.

What was challenging?
Some students are more vocal than others and some are better listeners than others. I noticed that in one particular group, two team members were doing most of the talking. I prompted the students who are more verbal to ask their peers who are less verbal to share their ideas. For example, I said, “Riley, your observations are very interesting. Did you ask Brayden what he thinks about that? Brayden was quiet for a moment before commenting on the order of one of the water samples. “Oh yeah, that does smell like fish,” Riley responded. “Aren’t you glad you asked?” I said to Riley with a smile. “I wrote dirt, but [fish] makes sense because the water is from a pond.” Riley changed his response on his paper and I watched the two boys continue a conversation about the water sample.

My goal was to recognize the contribution of the students who are more vocal while simultaneously making it known that everyone’s voice should be heard and valued.

What I would do differently next time?
Perhaps next time I will ask half of the class to collect a sample from inside the home, while the other half collects water outside. The variety of samples might make the investigation more interesting and give students a better sense of how materials in water affect its quality.

Since I have enough vials, it would also be possible to have students collect samples over the course of two days. This too could ensure a variety of samples.

What I noticed about individual students?
When Brayden was given the opportunity to share his thinking, he made worthy contributions to the conversation related to water samples. This made me wonder how he could have enhanced other learning experiences but wasn’t able to because he wasn’t presented with the opportunity or lacked the confidence to volunteer his thinking.
The table for comparing water samples also contained a section for other observations. In his table, Alan wrote “This ice cube water smells just like strawberry ice cream.” “Why do you suppose that is?” I asked. “Probably because the ice cubes were sitting on a shelf in the freezer right next to ice cream! They’re both in the freezer!” Perhaps Alan was inferring that the ice cubes has taken on the scent of the ice cream.

Day 24
Water Wheels

Lesson Summary
I began the lesson by asking, “What are some ways people use water?” Students discussed using water to shower, drink, make food, wash clothing, and swim. I suggested that they put water to work in today’s investigation, and I directed their attention to the waterworks poster. I encouraged them to describe what was happening in the image and how water was used to do work. I asked them to think of other examples of water doing work in the community. The Erie Canal runs through our community so students discussed how boats use the canal to move goods.

Next, I told students that people have used water to power machines for over 2,000 years, stating, “One of the ways people used water was to power water wheels. Water wheels were first used to turn stones that ground grain into flour. Later, they were used to power sawmills. Today flowing water through dams turns devices called turbines that create electricity.” The students viewed a video clip of a water wheel on YouTube.com (http://www.youtube.com/watch?v=EytzKJR6G70).

After viewing the video, I challenged the students to create a water wheel that could lift a load. We reviewed the materials for the lesson: plastic disks, a basin, a dowel, 2 medium binder clips, string, and ½ liter container for water. I encouraged them to experiment with putting the materials together to make a working water wheel, stating, “You will be successful when your water wheel design uses water to lift the load to the edge of the basin.” I showed them a binder clip and the string, and told them that the binder clip would act as the load and that they should tie one end of the string to the loops of the binder. I demonstrate what it meant to lift the load by holding the string out in front of me and lifting the clip from the floor.

Each group collaborated to come up with a design. I suggested ideas for students who were struggling.

- Use the binder clips on the basin to stabilize the dowel.
- Tie the string to the straw and secure it with tape.

I encouraged the students to refine their designs as they worked to create a smooth running water wheel. We used the word blade to describe the disks and shaft to describe the dowel.
When they had assembled their water wheels, I challenged each group to figure out how many syringes of water it would take to lift the load from the floor to the edge of the basin. I suggested that the fewer syringes it took, the more efficient the design.
4.44: Investigation: Water Wheels

After the challenge, students pointed out the components of their designs that may have made them more efficient. Students then recorded their findings in their notebooks.

In order to fully understand how water wheels are used to generate power, I had the students conduct research using the Internet and texts. They recorded their information on Post-its. The class reconvened to discuss their research. The students completed their Conclusion section.

Just as before, I prompted students to begin their explanation with a claim and to support their claim with evidence, “Remember, your evidence can come from your findings and your research.” I also encouraged students to include precise language and to reread their work carefully to check for proper conventions.

4.45: Student’s Research and Explanatory Writing for Water Wheels Investigation

Students reviewed their science notebook entries with a partner to be sure they included the appropriate sections: a research question, a prediction, procedures, findings, a visual display of data, and a conclusion.
Reflection

What went well?
My students worked diligently to design a working water wheel. Student’s head were huddled together and the room was noisy with the exchange of ideas. I was very impressed with how students collaborated to create a successful design. When one group developed a plan to connect the blades with the slots, they happily shared their idea with the other groups instead of worrying about others copying their idea. My students were persistent and understood this problem solving activity involved a process of trial and error. For example, Lindsay’s group tried putting the dowel through all of the blades before realizing this design wouldn’t spin when water flowed over it, like the one in the video. “Let’s try something else,” said Lindsay. The group took apart their design and discussed other plans.

In addition to refining their problem solving skills, students are developing competence with technology. I have noticed that they are navigating the Internet more easily and they are applying typing skill learned in computer class. Also, students are learning to use various programs and websites for instructional purposes. I will encourage students to apply these newly learned skills in our upcoming explanatory writing/research project.

What was challenging?
Students were limited to using the materials I provided. It would be interesting to see what students could create with self-selected materials from home or school.

What I would do differently next time?
I am wondering what ideas students with generate if they were not limited to my supplies. Perhaps I could begin by letting them use my materials, but not designating the quantity of each item. As an extended activity, students could create their own water wheel out of materials of their choice. Encouraging creativity and problem solving could yield some very innovative ideas.

What I noticed about individual students?
It was interesting to see how the six groups of students worked as teams. In one group, I observed how responsibilities were decided upon before any exploration. Each student was in charge of a different material. In another group, I watched how the students discussed ideas before manipulating the materials. The students in Brayden’s group paired up. While Brayden and his partner placed the blades on the dowel, the other team members attached the clips to the bucket.

When it came time using the syringe to lift the load, Alan and Brayden had difficulty sharing this task with their teammates. They were having fun and were very engaged in the activity, but needed reminders from me to let others have a chance to participate.

I have noticed that the students have become very good at including all of the science notebook categories. At the beginning of my study, I would verbally tell students to record each section of their entry. At this point, my students are taking the initiative to
document their procedures, findings, and data. They are also learning how to organize
and reread their writing to ensure it can be understood by others. I am especially pleased
with Diane’s progress. Organization was always a challenge for her, but through the use
of science notebooks, she has developed important writing and thinking skills.

Day 25
Providing Feedback on Science Notebook Entries

Lesson Summary
I began the lesson by announcing, “We have completed our unit of study related to water.
I filled out a science notebook rubric, which I will share with you today during your
writing conference,” I told my students. “You should all be proud of the progress you
have made within the last five weeks!”

I met with students individually to provide feedback related to their latest science
notebook entry. I began each conference by complimenting the student on an area in
which he/she had done well. The student had the opportunity to view the science
notebook rubric from the beginning of the unit to see how he or she had improved as a
writer and scientist. In addition, I encouraged the student to focus on one of the
categories for future science investigations. I guided students in making revisions to
explanatory writing.

Students then shared with me what they enjoyed or learned from the integrated science
and writing unit.
April 15, 2013

4.46: Student’s Science Notebook Entry

**Procedure**

First, I put the dowel through 4 of the 5 blades. Secondly, I stuck the 4 blades that are left and put a blade on each. Third, I put the clips on the long sides of the tub. Then, we put the dowel through the notches of the 2 clips. Now, Miss Deiboldt attached a meter long string with a weight on the top. Also, Miss Deiboldt gave us (my group) a syringe and a cup filled up to the very middle. I by tying the string and taping it. The string. Now, we sprayed the blades.

**Finding**

I found out that you need to push the syringe very hard and fast, the blades spin so fast that they spin and I wasn't able to lift the weight up to the top of the tub, where the dowel is. Also, don't forget to hit the edge and assemble the string on the ground.
Reflection

What went well?
Wow! When I look at students’ very first notebook entries and their last, it is truly amazing to see how they have developed as writers and scientists within the last five weeks. I set high, rigorous expectations for learning and my students rose to the occasion! The best part is that my students had fun while they learned about the world in which they live. My students are now conducting research on a wide variety of topics at home and once their work at school is completed. Ethan is learning about sea turtles, Sarah compiled her research about cats in a book, and Leslie created her own science notebook and is doing experiments with her father.

What was challenging?
By using science notebooks from the very start of the school year, I am certain that the students’ understanding of the various forms of expository writing, procedural, descriptive, and explanatory would be even greater. Despite their progress, the fast pacing proved to be a challenge for my struggling writers. With more time to practice the various forms of expository writing through the writing process and the application of the traits of good writing, and conferring with students individually to develop these skills, I know that all of my students, especially those who struggle, would gain confidence and competence.

What I would do differently next time?
In the future, I will provide students with more opportunities to practice each form of expository writing. In addition, I would increase my students’ exposure to various forms of expository text authored by a variety of authors so that they have models for writing other than my own. Reading expository text in books, magazines, newspapers, and on the computer may encourage students to learn about writing as they explore topics of interest.

What I noticed about individual students?
The purpose of my study was to learn how to use science notebooks to integrate the genre of expository writing and inquiry-based science. I also focused on seeking answers to four research questions:

How do I develop as a researcher and a teacher implementing the Common Core Standards for expository writing?
Through my research, I have come to realize that the Common Core State Standards for writing can easily be address through good teaching. As an educator, it’s important for me to examine important questions such as this so that I can grow as a professional.

How do I learn to teach through an interdisciplinary framework?
By conducting my study, I learned how to implement the science-writing approach. I knew that integrating content was important, but I wasn’t sure how to effectively go about doing so. I learned how to use science notebooks as a tool to
encourage my students to learn about science through writing in an authentic and meaningful way.

How can I support my students develop as thinkers, writers, inquirers, even those who are reluctant?

All of the students developed their abilities as scientists, writers, thinkers, readers, problem-solvers, researchers, and communicators. What I liked so much about the design of my study is that I differentiate my instruction to meet the individualized needs of all students. Students were writing in ways that enable them to extend their thinking at their own level. Two students who struggle as writers—Brayden and Diane—improved their text structure, sentence structure and use of spelling patterns, and students who were skilled writers—Ethan, Leslie, and Alan—developed skills that pertained to their needs such as text structure and use of ideas and language.

I believe that implementing this study provided Brayden and Diane with the opportunity to shine! I am also proud of Beckett because he is learning the importance of using writing to communicate with others. This learning experience involved the expectation that every student would succeed.

How can I provide more authentic feedback?

As part of the writing process and science-writing approach, I conferred with students individually to meet their unique needs. My students were very interested in the science research because they could generalize their learning to real world situations. Using student generated rubrics also made the process of providing feedback more meaningful. Students played an essential role in setting expectations and therefore were more apt, I believe, to work toward meeting and exceeding the expectations. I felt that I challenged my students to take an active role in their learning and progress, and we all had fun in the process!
Chapter 5: Conclusions and Recommendations

As a teacher researcher, I designed this study to explore the use of science notebooks as a tool to integrate the genre of expository writing and inquiry-based science.

As I conducted my research, I sought answers to the questions:

- How can I develop as a researcher and a teacher while implementing the Common Core Standards for expository writing into inquiry-based science experiences?
- How can I teach through an interdisciplinary framework?
- How can I support my students develop as thinkers, writers, and inquirers, even those who are reluctant?
- How can I provide my students with more authentic feedback to support their development as thinkers, writers, and inquirers?

In this chapter, I describe the conclusions to my research based on the evidence I gathered throughout my study. I also discuss the ways in which my students benefitted from the research study as well as how my research has and will continue inform my teaching philosophy and practices. I concluded the chapter by highlighting three recommendations for future research.

Conclusions

How can I develop as a researcher and a teacher implementing the Common Core Standards for expository writing?

Conduct a Self-Study Related to Interdisciplinary Instruction

I conducted a self-study in order to reflect upon and refine my teaching practices related to literacy and science. More specifically, the purpose of my study was to learn how to integrate the genre of expository writing and inquiry-based science through the use of science notebooks to better meet the needs of my students. Incorporating writing into science allowed me to align my instruction to the Common Core State Standards.
As a teacher researcher, I conducted my research in my classroom, in order to fully explore my research questions and to improve my teaching of the standards through an interdisciplinary framework.

As part of my research, I read literature on methodology related to writing instruction in the elementary classroom, inquiry-based-learning, the integrated science-writing approach, science notebooks, and the Common Core State Standards for writing. I also learned how to adopt a purposeful and effective method of collecting data. Through my use of a research journal, I was able to carefully analyze and reflect upon student observations and my interactions with and among students to adjust my teaching philosophies. I now have a stronger desire to teach through an interdisciplinary framework. Professional scientists spend a great deal of time writing about their inquiries. Reading professional literature and analyzing the writing in my own research journal prompted me to recognize that science and writing are natural complements, and by integrating the two subject areas, I can create meaningful and authentic learning experiences for students.

Scientists are readers, writers, thinkers, and mathematicians. This was evident in the PowerPoint slides I presented to my students on the very first day of the study. The photos depicted scientists engaged in scientific investigations as well as samples of science notebook entries. In the sample notebook entries, scientists used writing as a means of documenting research. One scientist used mathematical formulas to aid in the development of his discoveries. Another scientist was shown at the computer reading literature related to his topic of study, and in most the slides the scientists were portrayed collaborating as a team. My students pointed out how important it is for scientists to use
math and writing throughout the discovery process. Alan, for example shouted “Look, that scientist did multiplication!” when he saw one particular science notebook entry. Another student commented on the amount of writing the scientists had produced in another notebook entry.

I was surprised to learn how easy it was to incorporate math and expository writing into inquiry-based-science investigations. I noted in the first entry of my research journal that my students would be using various tools for measurement, however, my students practiced and reinforced many other math skills throughout the science unit such as writing fractions and decimals, finding an average, and using tables to organize data and problem solve. As for writing, I discovered that expository writing was a powerful thinking tool. Through writing, my students learned to understand abstract concepts. For example, during the Building a Thermometer investigation, Brayden was handling the glass bottle device and announced, “It’s like the temperature!” I asked him to elaborate on his comment and he explained that the water moving up and down the straw reminded him of the thermometer in the classroom window. Brayden was often reluctant to write, but he got right to work documenting his thinking in his science notebook. In his response, he discussed how the room-temperature water in the straw expanded, and rose up the straw, when the bottle was placed in hot water as well as how the room-temperature water contracted, and went down the straw, when the bottle was placed in cold water. Not only did Brayden incorporate new vocabulary into his writing, he was able to deepen his conceptual understanding of how a thermometer functions through the process of writing.
During my personal inquiry process, I discovered the significant impact that integrating math, writing and inquiry-based-science can have on learning experiences, and I feel that it is my responsibility, as a researcher, to communicate my findings with my colleagues. My research was prompted by my confusion about how to effectively teach to the Common Core State Standards and my desire to provide my students with the best possible learning experiences. I was devoting so much time to lessons from my school’s newly adopted literacy and math programs, aligned to the standards, I had little time left for the teaching and learning of science concepts. I knew I was doing a disservice to my students and they expressed their disappointment. My sense of dissonance influenced me to investigate the problems I faced in my classroom. Through discussions with my colleagues, I was aware that they faced the same conflicts. They were also neglecting science instruction to spend more time on literacy and math concepts from the new learning programs. It is my hope that sharing my conclusions will encourage my colleagues to also consider implementing an interdisciplinary approach due to its significant impact on learning. Not only did my students develop and refine essential academic skills, our learning experience was enjoyable and rewarding.

**Employ Sound Instructional Practices**

The Common Core State Standards ([http://www.corestandards.org/](http://www.corestandards.org/)) establish a set of clear goals and expectations for the knowledge and skills that students should achieve by graduation so they are successfully prepared for college and careers. These standards, however, do not imply how a teacher should teach. As an educator, I realize that in order to support my students in developing important literacy and math skills
established by the Common Core State Standards, I must employ sound instructional practices. Inquiry-based-learning and the writing workshop are research-based practices, and the evidence I gathered in my research journal supports the success of these practices within my classroom.

I implemented inquiry-based-learning and the writing workshop while enabling my students to work with the concepts defined by the Common Core State Standards, specifically writing standard two. This standard states that students will write informative/explanatory texts to examine a topic and convey ideas and information clearly (http://www.corestandards.org). I utilized an integrated science-writing approach to address this standard.

Throughout the inquiry-based-science unit about water, I used the writing workshop to scaffolded instruction related to procedural, descriptive, and explanatory writing. Using the writing workshop as a model, I provided my students with explicit instruction for each form of expository writing, and provided my students with time to develop the taught writing skills. I also conferred with my students individually to offer support and feedback. The content of our writing was always linked to our inquiry based science investigations. I learned that my students could explore and deepen their conceptual understanding of science concepts and ideas through the process of writing.

As Brayden, Ethan, Leslie, Beckett, Sarah, Alan, Diane and all of my other third graders were writing about their experience with designing a functioning water wheel, they were also developing as writers of expository text by applying what they had learned from my writing workshop lessons. In addition, through sound instructional practices
such as inquiry-based-science and the writing workshop, my students could work toward mastering writing standard two for the Common Core.

**How can I create a balance between science and writing experiences?**

As a result of my research, I discovered that infusing opportunities for students to use expository writing in science can have a significant positive impact on their ability to extend conceptual understanding of science concepts. In order effectively implement the science-writing approach I realized how important it was to create a balance between science and writing experiences. Throughout my study, I modeled three forms of expository writing: procedural, descriptive, and explanatory, and I used scaffolding to support the individual needs of my students. At the same time, I engaged my students in inquiry-based-science investigations about water. The goal of my research was to understand how to successfully combine writing and science, which I believe I achieved through the use of science notebooks.

I learned that the science component of my interdisciplinary instruction should be designed to involve four major stages: engagement, active investigation, shared reflection, and application. During the first stage, I began by prompting my students to activate their prior knowledge related to research questions. From my experience, I learned to tap into my students’ prior knowledge by facilitating rich discussion. In the past, I struggled trying to get my students to use evidence to support their thinking, but providing justification during our conversations was necessary and natural.

During the second stage of the science session, I learned that it was necessary to provide my students with ample opportunities to handle investigation materials, record the procedures, and collect data related to the research questions. Teaching my students
to visually organize data from investigations was important. Throughout the unit about water, I guided my students in using specific visual representations such as charts and tables; however, in the future, I would like to provide my students with the freedom of choosing to display data in a way that makes sense to them. For example, a tally chart and a bar graph could be used to highlight the same information.

After providing my students with opportunities to explore the materials, I taught my students to document observations in their science notebooks. I learned that my role as the facilitator was to guide students in using precise language and critical thinking to enhance the quality of their entries. During the Evaporation investigation, for example, I prompted my students to write their observations about the two cups we were had just placed in the windowsill. Both cups held a wet paper towel, only one cup had a lid. Earlier in the lesson we discussed the meaning of the word exposed, and I encouraged my students to use this word in their writing in addition to providing as much detail as possible. My own research has reinforced the idea that detailed observations are key to making excellent discoveries and so I learned the importance of making it a teaching point as part of my explicit instruction.

Collaboration and exploration were essential components of stage three of each science session. One thing I will always keep in mind is that students, especially those who struggle, need multiple opportunities to view and manipulate materials so that they can begin to develop and deepen abstract thinking. I made sure that materials were always accessible. During the water wheel investigation, I encouraged Brayden to spend extra time to exploring the tools as well as engaging in conversation about his experience. I realized that this was a necessary step in helping him develop an understanding of how
water wheels function. This experience also impacted his ability to write about his learning. If my students struggle to speak or write about a concept, I must provide them with additional time to study concrete materials.

Facilitating discussions was a beneficial way to encourage my students to draw conclusions related to the inquiry unit about water. I learned how important it is to provide my students with opportunities to apply science language and discuss their thinking with others so that they can apply new learning to expository writing. I can challenge my students to establish a deeper understanding of the science concepts through information text such as book, the Internet, and online sources. Through the Conclusions section of the science notebook, I urged my students to synthesize their findings from the investigation and their research to explain their learning. During the sinking and floating investigation, my students discovered that hot water floated to the top of the room temperature water and cold water stayed in a vial at the bottom of cup of room temperature water. Lindsay connected these findings to a sinking and floating activity from the previous day, but she did not yet have an answer to why some objects sink while others float. She used informational books and an online encyclopedia to obtain additional information, and she used post-its to record relevant information that she then brought back to share with the group. Together, my students were able to identify density as a factor in whether things sink or float. I enriched the discussion with a bit of explicit instruction to support my students as they explained their learning in their science notebooks. In all investigations, informational text and collaboration played an important role in my students’ understanding of science concepts. I must keep this in mind as I engaged my students in future investigations.
I noticed that my students’ pursuit for answers often encouraged them to develop new questions related to the investigation. Beckett was full of questions once he began conducting research on the Internet related to the investigation about sinking and floating. “What about alligators? Sometimes they float in the water and sometimes they go underwater? How come they don’t stay at the top or just stay at the bottom? Beckett’s questions were intriguing and he was connecting new learning to a real world situation, which was one of my goals for implementing inquiry-based-learning and using science notebooks.

Professional scientists document data and observations in science notebooks so that they can reexamine it and do something with it later. Therefore, during the fourth and final stage of the science session, I discovered that my students needed to apply their learning to other situations. One morning, for example, there were puddles on the ground from a rainstorm the night before. Eli commented on how disappointed he was that recess wouldn’t be on the playground that day. Shortly after Eli’s comment, the sun came out. “We have three hours until recess, do you think we’ll be able to play outside?” I asked. They were all in agreement that the heat from the sun would cause the puddles on the playground to evaporate so that we could enjoy recess outdoors. My students generalized what they learned about the water cycle in science class to a real world experience. Based on my experience, I strongly believe the application stage is critical to the authenticity of inquiry-base-learning.

I designed the science-expository writing sessions to serve several purposes: they were an opportunity to review the science investigations, and teach minilessons centered
on different forms of expository writing, and they provided students with time to apply writing skills and their thinking about science concepts to notebook entries.

Before modeling a new form of expository writing, I spent time reviewing the previous investigation with students, and science materials were available for students to view and manipulate during this time. I believe reviewing investigations and having materials on hand played a critical role in the success of my minilessons because I relied on my students’ input to provide the content of my writing. For example, as I modeled explanatory writing, I encouraged students to share their observations, evidence, and thinking about the relationship between surface area and the rate of evaporation. I prompted students to include evidence from a variety of sources and scientific vocabulary in their explanation so that I could incorporate it into my writing model. I believe my students were able to get more out of my model lessons because the content of my writing drew upon something they had all experienced.

As part of the next step in my science-expository writing sessions, I collaborated with my students to generate rubrics for explanatory writing based on my models of procedural, descriptive, and explanatory writing. For each occasion, I urged my students to study my writing model from the previous lesson in order to identify important elements of that particular form of expository text. These elements became the categories on the rubric. Next, I prompted my students to develop criteria for each category using a scale from one through three, three being the best. I believe that providing my students with the opportunity to develop the criteria for writing helped them in understanding and working toward meeting the expectations. Even Diane and Brayden, my writers who struggled, actively participated in the process by offering ideas.
Involving my students in the design of the rubrics for procedural, descriptive, and explanatory writing stimulated a greater level of commitment to improvement. This was evident during the individual conferences I held with my students. During the investigation about condensation, I guided students in developing their conclusions. I encouraged them to reference my exemplar from the model lesson as well as the rubric to develop their notebook entry. Individually, I met with students to give feedback, using the rubric to identify their strengths. “I noticed you did a really good job using precise language,” I said to Lindsay pointing to her rubric. Then, I read aloud an example of this from her science notebook entry during her conference. Near the end of the conference I asked, “What would you like to do to improve your writing and scientific thinking?” I found that my students were eager to select an area of focus based on the criteria from their rubric. Moreover, I showed my students how to set and work toward goals that were unique to them.

As a result of my scaffolding, I noticed a shift in the way my students engaged in the writing process throughout the five weeks of study. During our regular conferences, I supported my students as they made revisions to their entries. Depending on the student, this may have been elaborating on ideas, organizing information, adjusting conventions or incorporating precise language. I encouraged my students to work independently or with a peer to make additional edits. Throughout the five weeks, I recognized how conscientious my students were becoming in independently making edits to their writing before meeting with me for a conference. My students were coming to conferences prepared to read and discuss their work, which enriched the quality of these
meetings. I felt as though I could support my students in refining their writing and thinking because they had already devoted time to making meaningful improvements.

My experience with the science-writing approach has greatly enhanced my confidence and competence as an educator. I strongly believe that integrating inquiry-based-science with expository writing through the science-writing approach has challenged me to provide my students with better learning experience.

**Integrate Inquiry-Based-Science with Oral Language and Reading**

As my students engaged in science investigations about water, I was able to foster the development of important literacy skills such as oral language and reading. Connecting literacy with science occurred in a natural and meaningful manner.

Throughout the inquiry-based unit about water, I engaged students in a number of activities that promoted their development of oral language, specifically vocabulary related to science concepts. Before, during, and after, the investigations, I had students actively discuss their thinking in pairs, small groups, and as a whole class. I learned that through rich classroom discussion, all students could acquire new vocabulary and were able to make connections and develop a deeper understanding of science related concepts. During one particular investigation, my students collected samples of water from locations around the community to study the effect of materials on water quality. This investigation, like all the others, was a great opportunity to promote the use of new vocabulary (source, clarity, odor, particles, and organisms), and as I moved among the groups, I overheard students engaging in rich discussion and applying these new words. “This is quite odiferous!” Ethan exclaimed when he took a sniff of one particular sample. “The odor is rotten garbage,” his teammate added. During another investigation related
to evaporation, Diane used the word moisture to describe a paper towel when the lid on the cup prevented evaporation to occur. Discussion and writing are authentic ways to foster the acquisition of vocabulary.

My experience encouraged me to reflect on the importance of providing my students with opportunities to use new language as they engage in hands on exploration. Furthermore, it is essential that I encourage my students to use new vocabulary in a meaningful context, so they continuously develop oral language skills.

I discovered I could also help my students improve as readers while they participated in science investigations about water. For example, I required students to read and reread their science notebook entries to make revisions and edits. I learned from professional literature that this made students who struggled feel successful because they were practicing with text at their own level. Diane spent a great deal of time rereading her notebook entries. When she realized that her writing did not match what she intended to communicate, I encouraged her to adjust her writing, which had a significant impact on her reading fluency. Diane also developed a great sense of pride in her work ethic and reading skills.

I found it beneficial to prompt my students to use various pieces of informational text to further explore science topics. In order to research information related to our investigations, I urged my students to use book as well as sources from the Internet. I noticed that as they gained experience investigating topics, they were developing the ability to think critically about text.

When Alan, for example, was using the Internet to learn more about water wheels, he came across information that did not align to another source he had utilized. “Your
research is contradictory,” I told him. “It’s important to use a variety of sources so you can ensure you’re learning relevant or accurate information.” Indeed, he found that only additional research helped determine what to believe. By exposing my students to informational text, I was able to challenge them to extend their learning beyond the hands-on investigation.

Integrate Inquiry-Based-Science and Third Grade Math Skills and Concepts

One of my reasons for initiating my research was to resolve my struggle to find adequate time during the school day for science instruction and exploration. I felt that I had hardly enough time for literacy and math. However, I discovered how easy it is to incorporate math concepts into science investigations, specifically related to our unit about water. During my first model lesson, I demonstrated how to create a table to collect and represent numeral data, which surprisingly aligned with a math lesson I taught about using tables to identify number patterns. Throughout the unit, I found myself prompting my students to practice other math skills, such as fractions, reading a thermometer, measuring liquids in both metric and the U.S. Customary system, and calculating an average during science investigations. I truly feel that in all situations, I encouraged my students to reinforce and apply math concepts in a natural way because they applied to real world experiences. Despite introducing three other classes to the inquiry unit about water, I underestimated the presence and importance of math in the inquiry process, until now. I learned to capitalize on the interconnectedness of math and science, and I strongly believe that by doing so, I fostered a deeper understanding that math plays an important role in everyday life.
How can I support my students develop as thinkers, writers, and inquirers, even those who are reluctant?

Promote Ownership of Inquiry and Enhance Student Interest

Throughout my five-week study, I discovered several benefits to teaching through an inquiry model. For one, I successfully motivated my students to take ownership of their learning. In addition, I enhanced my students’ engagement in the process of learning science and writing. As a result, I my students grew as thinkers, writers, and inquirers.

My students, like all children, are naturally inquisitive and so it made sense to implement a teaching practice, such as inquiry-based learning. As part of the inquiry process, I facilitated investigations in which students exercised the scientific process. Students’ documented research questions, predictions, procedures, data, findings, and conclusions in their science notebooks to explore concepts about water.

Providing students with the ability to make choices is an essential part of the inquiry process. I realized that by encouraging students to make decisions, I was empowering them to determine their own direction of learning. I made my students responsible for choosing how investigations should be conducted as well as how data should be gathered. During the Surface Area investigation, my students collaborated to determine which tool we would use to measure the amount of water that remained in each container, and I urged them to establish a clear procedure to ensure the control of variables. Through inquiry-based-learning, I was able to promote self-directed learning skills, enabling my students to problem solve, commit to goals and maintain continuous
motivation. My students were eager to resolve research questions and persevered despite challenges. This was evident during the Water Wheel investigation. As part of the challenge of producing a functioning water wheel, students had to decide which materials would be used and how they would be assembled, devise a plan for testing the water wheel, and determining how they would document their process of inquiry. I was truly impressed by their level of success!

Encouraging my student to take an active role in their learning also resulted in a higher level of engagement. Although my students’ life experiences were very different, they all had background knowledge related to water, and through our investigations, they were motivated to formulate new knowledge by refining and modifying their current concepts and misconceptions. Brayden, for example, connected what he was learning about condensation to the cloudy mirror in his bathroom after a shower. “So that’s why that happens!” he exclaimed. In the weeks following the condensation investigation, my students shared anecdotes of their new learning. “There was condensation on the windshield of my mom’s car this morning,” Lindsay said one day. “Alan was making condensation at lunch by breathing on his ice pack!” Sarah giggled. Rarely did I have to address behavioral problems because my students were excited to engage in learning about science.

I believe that by encouraging a process of inquiry, rather than a process of accuracy, I created an environment in which students were fully committed to learning experiences. In order to promote this idea, I ensured our learning was mediated in a social environment in which my students could interact with one other to discuss experiences and thinking. At the beginning of the unit, Brayden and Diane rarely spoke
up during discussions about water, but by the end of the five weeks, they were active participants because their learning was based on their experiences. I used inquiry to help my reluctant students, like Brayden and Diane, build self-esteem by influencing them to be more active in their own learning process.

Overall, I successfully supported all of my students by adopting an inquiry-based approach to learning. I inspired my students develop self-directed learning skills and as a result, of taking ownership of their learning, they were enthusiastic about expanding their knowledge related to science and writing.

**Use Science Notebooks as a Tool to Promote Learning**

Throughout the study, students generated notebook entries to record questions, evidence of thinking, data, scientific drawings, and conclusions, in ways similar to professional scientists. The content of their notebook entries indicated evidence of their development as thinkers, inquirers, and writers, even those who struggled.

I invited students to use their science notebooks to document their thinking, findings, and conclusions, which prompted them to make new discoveries about the science concepts. As students wrote about the investigations, they worked to confirm and extend ideas both during and after science investigations. For example, When our class explored the phenomenon of condensation, Lindsay wrote in her Findings section:

\[
\text{[The cup of ice water] is wet on the outside. The water on the outside of the cup is clear. It’s like it’s sweating. I’ve seen this on cards. The [cup with] room temperature water is not wet on the outside. Why is it not wet on the outside?}
\]
I noticed that Lindsay was determined to find out why the water appeared on the outside of the cup with ice water and not on the cup of room temperature. Through her research and my explicit instruction, she concluded:

Condensation is water vapor or invisible gas. The cup [with ice water] was sweating evaporation, a previously studied concept. Condensation is the opposite of evaporation because it’s liquid to water vapor [and condensation is water vapor to liquid]. After evaporation the clouds rain and then the whole process of evaporation and condensation starts all over again.

Lindsay constructed her own conceptual understanding of condensation, and interacted deeply with the concept by asking a relevant question related to the topic. She was also able to make a connection between condensation and evaporation, demonstrating her ability to grasp the core concept.

Diane, one of my students who was reluctant, made significant gains throughout the unit of study. I noticed that her thinking about science concepts improved when she had opportunities to talk and write about the investigations. During the water on a slope investigation students were exploring the idea that water flows downhill. In her notebook, Diane recorded the research question and her prediction. In her procedures, she recorded each step in sequential order and used transitions for sentence fluency. In her Findings section, she wrote:

First, we found that the water will make a dome [on a flat surface] and when it get bigger the dome will move. It will move down faster when it is big and when it is small it will go down slow. Now we made the slope steeper and [the dome] go’s even faster.
Diane concluded that water always flows downhill. In addition, she was also able to determine that the bigger the bead of water, the faster it will flow downhill. She discussed recreating the investigation at home using materials from her toy room. Although she began the study as a reluctant writer, her thinking and understanding of the science concepts were clearly revealed in her notebook entries. Through more practice with writing about science concepts, Diane became more confident in her writing skills, and I attribute this to the use of science notebooks.

Throughout the process of keeping science notebooks, my students asked questions about science, wrote appropriate predictions, recorded procedures, and documented their findings and new learning within one entry. I found that science notebooks truly are an authentic means for all students to learn about a concept and a topic that has relevance to their everyday lives.

**How can I provide my students with more authentic feedback to support their development as thinkers, writers, and inquirers?**

**Use Teacher and Student Generated Rubrics during Conferences**

I recognize that providing feedback is an essential component of supporting student success and my work as a teacher. I used both teacher and student generated rubrics as a tool to provide feedback during conferences. My constructive and valuable feedback was specific to the students’ unique levels of understanding and development.

Rubrics were an important tool for providing my students with feedback throughout my study. Although my students had experience with using rubrics for writing, I had never invited them to partake in the process of creating one. I was
responsible for developing the science notebook rubric because my students had not yet used science notebooks, and I had specific categories and expectations in mind. However, my students and I collaborated to generate rubrics for procedural, descriptive, and explanatory writing, using my science notebook exemplars as a guide. Yopp (2006) suggests that exposure to informational text impacts literacy development. I believe that inviting students to create rubrics was beneficial because they were required to read, reread, and analyze my expository text exemplars. This experience fostered a stronger understanding of the features of procedural, descriptive, and explanatory writing as well an excitement for writing. My students communicated that they enjoyed having the opportunity to create the rubrics, and unlike before, they often referred to the rubrics as they crafted their writing.

My students’ science notebook entries were essential for monitoring progress and providing authentic feedback. Based on their entries, I used the rubrics to document the areas in which students were doing well and where additional instruction and practice was needed. I shared my feedback during individual conferences. In the past, the feedback I provided during conferences was focused on one subject area, usually reading or writing. I had never conducted conferences about science. With the use of the teacher and student generated rubrics that integrated writing and science, I felt that I was able to support my students as they developed as thinkers, writers, and inquirers.

I established teaching points and scaffolded instruction during weekly conferences, but unlike before, conferences enabled me to explore their thought process regarding science concepts as well as aspects of expository writing. I was able to affirm and reinforce each student’s strengths by meeting with them individually. I also used
conference time to assess the students’ confusions or misconceptions about writing or science concepts, which led to teachable moments. Viewing their entries, completing rubrics, and asking them to talk about their thinking allowed me determine the direction I needed to take in terms of my instruction. During the first week of my unit, I noticed Brayden was recording information in any available space on his science notebook page. I documented this on the science notebook rubric and addressed my concern. He had difficulty reading and making sense of the investigations during his conference so I provided him with explicit teaching regarding the use of science notebook categories (research question, prediction, procedures, findings, and conclusions) to organize his writing, and I continued to scaffold instruction throughout the unit of study. As I worked with Brayden to organize his writing, I was also guiding him in understanding and applying the scientific process.

Teachable moments were unique to each individual. For example, when I spoke with Sarah about the evaporation investigation, she was very articulate in describing her findings. Her writing, however, did not clearly portray her observations. Together, we worked to elaborate on her ideas. I prompted her by asking, “What else do you want others to know about the paper towel that was in the cup without the dome lid?” or “What did you and your group members discuss when you saw the cup with the dome lid?”

At the conclusion of each conference, I encouraged students to use criteria from the rubrics to set personal goals so that they would feel motivated to continue exploring science concepts through the writing process. I learned that teacher and student generated rubrics are an important tool for providing individualized, immediate, and
meaningful feedback during conferences, and I believe my feedback played a significant role in their development, not only as writers, but as scientists and thinkers as well.

**Implications for Student Learning**

It is clear that my students benefitted from participating in my study. Implementing inquiry-based lessons generated excitement about science, which stimulated a higher level of student engagement. In addition, my students learned to write and conduct science investigations using a similar process as professional authors and scientists.

**More Engaged Learners**

I noticed a change in my students’ attitudes toward learning as a result of our science-writing unit. For five weeks, my students used writing for thinking, inspiring them to become more engaged in their learning. As part of the experience, we fostered a supportive and flexible climate conducive to different forms of expository writing and inquiry-based science explorations. In this environment, I perceive that students were open-minded risk-takers ready for the next adventure, and I believe all of my students, including those who were reluctant, were eager to learn because learning was authentic. Before my study, Brayden would rarely share his thinking with others, whether it was in a whole group or small group setting. Throughout the study, he began speaking up more. I believe he felt that his classmates and I valued his thinking. During one particular lesson on density, Brayden used his background knowledge related to fishing in the Erie Canal to discuss his predictions about whether objects would sink or float in a bucket of
water. Brayden was engaged in the lesson because he was able to connecting the investigation to a real world experience. I believe that he saw the importance in what he was learning and therefore, enjoyed the experience and was more interested in participating in future lessons. In addition, I perceive he was more open to communicating with others because the sharing of ideas was linked to his experiences. Throughout the remainder of the school year, this perception toward learning sustained, stimulating an excitement for learning. My students, like Brayden were able to write and discuss their thoughts about science concepts to make sense of the world in which we live. Not only was learning connected to real world experiences, I encouraged my students to take multiple paths to the same learning outcome, which made learning fun and meaningful.

Use a Process Similar to Professional Scientists

Through the use of science notebooks, my students exercised the scientific method and science process skills, in a similar manner as professional scientists. In the book, Science Notebooks, Writing about Inquiry by Campbell and Fulton (2003), the authors interview two scientists who promote the use of science notebooks in the classroom. One particular scientist by the name of Kay Rohdes worked as a cave specialist. Rohdes mentioned that she did not remember using a science notebook in school, but wished that she had because it’s a natural part of doing science. In her own science notebook, she described observations and notes about the wet places in a cave, which prompted hydrological studies and also influenced the creation of maps of the cave. During the interview by Campbell and Fulton (2003), she expressed that, “using a
notebook will help kids be able to verbalize and describe. Recording in the notebook will help in vocabulary development and describing; being able to write descriptively is better in the long run no matter what they do” (p. 61).

On the first day of my study, my students and I set a purpose for generating notebook entries: to explore scientific content in a similar manner as professional scientists. As my students viewed photos of scientists in the slideshow, they realized that science involved a great deal of reading, writing, math, and communicating with others. As the teacher, I recognized the important role that Common Core State Standards could play in science investigations. Although I was incorporating multiple literacy and math standards, my focus was on Common Core Writing Standard two: writing informative/explanatory texts to examine a topic and convey ideas and information clearly (http://www.corestandards.org/). I encouraged my students to record questions, predictions, data, findings, and conclusions using the process of using the scientific method to work toward mastering this standard.

As students practiced the scientific method, they were excited to make discoveries about the world in which we live. The inquiry process motivated even my students who were reluctant. During the Evaporation investigation, for example, Diane organized her findings into two parts: one related to the cup with the paper towel exposed to air and the other related to the cup with the dome lid. She wrote: “I found that the cup with no top on it has no moisture in the paper towel. I found that the cup with a dome lid has a moist paper towel.” In my reflection journal, I noted that we had never used the words moist or moisture in the classroom. She either heard a classmate use these words or knew these words from another context. Regardless, she was motivated to incorporate new
vocabulary and write descriptively. As Rohdes (Campbell & Fulton, 2003) expressed in her interview, Diane was using her science notebook to develop vocabulary and descriptive writing skills, which will be of benefit to future learning situations. Ultimately, the use of science notebooks provided an opportunity for all students to conduct investigations using the scientific method, the same process that professional scientists follow. Our experiences also incorporated literacy and mathematics therefore making learning authentic and important.

**Use a Process Similar to Professional Writers**

My students have become avid writers. With each day of the five-week unit, they developed stamina. More importantly, they learned to write with meaning because they were writing about topics of high interest. Lindsay, for example, enjoyed writing about putting items in a bucket of water to test for density, which prompted her to investigate this topic further at home. She created her own science notebook to record additional observations and thinking. Ellen, Sarah, Ethan, and Alan were so keen on learning how to communicate ideas through the use of science notebooks, they independently researched topics of interest at home and summarized their learning in the form of posters, books, brochures, and graphic organizers.

My students learned to think, talk, and write to convey ideas, like professional authors. They experienced the writing process: drafting, revision, and editing to improve their expository writing pieces. My students were able to apply their experiences with the writing process to the expository writing unit that followed, which required students to write a research paper on an animal of their choice. My students generalized their
research and writing skills to this task, and unlike science notebook entries, published their writing. As part of the writing process, my students also received my guidance with specific strategy instruction because the traits of good writing: ideas, organization, voice, word choice, sentence fluency, and conventions are apparent in any exemplary composition. In the future, I expect my students to continue developing as writers, especially with the new knowledge and skills they have acquired.

**Implications for My Teaching**

I am confident that my experience conducting this study will continue to have a positive impact on my future teaching. I have benefited from the findings from my research in numerous ways.

**Continue to Grow**

In order to conduct my study, I read professional literature, reflected upon my philosophies related to teaching, and observed and analyzed my own teaching and the learning of my students. My research has truly changed the way I teach! Before conducting my research, I was concerned about the lack of time for teaching and learning. After reading research by Calkins (2006), Fulwiler (2007), Campbell and Fulton (2003), and Gilbert and Kotelman (2005), among others, I discovered how to teach through an interdisciplinary framework. By integrating science and writing through the use of science notebooks, I was able to support my students as they developed as thinkers, writers, and inquirers. What impacted me the most was learning how to create
an environment where students could work just as professional scientists and writers do while having fun in the process.

I view research as an authentic way to develop professionally. In order to successfully meet the diverse and unique needs of my students, I will continue reading literature in light of current research and engage in self-study practices surrounding my questions within my classroom.

**Use of an Interdisciplinary Framework**

My views and attitude toward the Common Core State Standards have changed since implementing my study. Prior to my research, I was stressed and overwhelmed about aligning my instruction to the standards. I taught literacy, math, and science in isolation; each subject had its own block carved out on the schedule. I was struggling to find enough time in the school day for literacy, math, and science. I strongly believe my decision to teach through an interdisciplinary framework resolved my dissonance, but also resulted in a higher level of success for all of my students. Teaching through an interdisciplinary framework opened my eyes to teaching literacy and math through science.

My research reinforced the idea that literacy is woven into all that we do. I learned how to teach science concepts while simultaneously promoting my students’ development of reading, writing, speaking, and listening. Through the use of science notebooks, I will help my students, especially those who struggle, become more comfortable with the writing process by supporting them in using both visual and written text to communicate. In addition, I will promote the development of oral language skills.
by encouraging my students to use precise language. Through discussions and writing, my students can acquire new vocabulary. In addition, I will also support my students in developing as readers by exposing them to informational text related to science topics. Informational text is an essential part of the science curriculum because it can be used to model text structure and language, answer students’ questions about science, and pique their interest about topics.

In addition to literacy skills, I learned how to integrate specific math skills and strategies into science. Combining the two subjects made learning feel more authentic because I was able to demonstrate the importance of using math in everyday life. In the future, I will work toward finding additional ways of incorporating math skills, addressed by the Common Core State Standards into science. I would also like to focus on finding ways of encouraging students to generalize math skills to other areas.

I now possess the knowledge and skills to effectively integrate core and content instruction, and I will continue to refine how I implement interdisciplinary instruction so that I can promote the development of essential reading, writing, oral language, math, and science skills.

**Use of Scaffolded Instruction**

All of my students showed a significant amount of growth in my five-week inquiry-based unit. I credit their progress to my dedication to scaffolding instruction and ensuring that my feedback was unique to each student’s needs. Throughout the science-writing process, I provided explicit instruction related to expository writing, I invited my students to engage in shared writing activities, I urged my students to participate in
discussion focused on writing and scientific concepts, and I conferred with students individually to support them in developing as thinkers, writers, and inquirers. Using instructional scaffolding allowed me to become more of a facilitator of knowledge because I encouraged my student to take on an active role in learning. I will continue to scaffold instruction through an interdisciplinary approach so that I challenge my students to move beyond their current skill and knowledge levels and take ownership of their own learning.

**Use of Science Notebooks**

I discovered that science notebooks are an authentic way for students to learn about science concepts while developing essential academic skills such as reading, writing, oral language, and mathematics. In addition, I found that science notebooks are an effective tool to promote thinking and differentiating learning. I will make science notebooks an everyday part of learning in my classroom because I recognized their significant impact on writing and science. Finally, my students and I enjoyed using notebooks to learn and discover new ideas.

**Use of Teacher and Student Generated Rubrics**

In order to support my students’ development, it is essential that I provide them with individualized feedback. In the past, I never conferred with students about science concepts. Now that my students are using science notebooks, I can use their predictions, data, scientific drawings, questions, findings, and conclusions to determine their understanding of concepts as well as their misconceptions. This was difficult to do in the
past through class discussions and pre-made handouts. Now that I reflect on my previous practices, I provided my students with very little feedback related to science. Now, I view both teacher and student generated rubrics as an important tool for providing my students with feedback during conferences.

Conferring with students individually and using student-generated rubrics as a tool will enable me to offer ongoing feedback both verbally and in the form of writing, and involving students in the process of developing rubrics will also provide them with a better understanding of expectations and boost intrinsic motivation. Asking questions during conferences will stimulate my students to progress in their thinking and writing. Furthermore, I anticipate that I will become a better facilitator of student learning because I have learned to simultaneously provide valuable feedback for both writing and science.

**Recommendations for Future Research**

Although I have established conclusions related to my research questions, I now have new questions that I believe are worth investigating. Researching these questions would extend my learning related to my topic of study and certainly be a benefit to my teaching practices as well as the academic experiences in which I provide my students.

**How could the new math program as well as the new literacy program be used as part of an interdisciplinary framework?**

As I stated in chapter one, my colleagues and I adopted a new math program and literacy program aligned to the Common Core State Standards. Implementing these academic programs has made it challenging for me to integrate core and content instruction, but nonetheless, I am expected to use and follow these teaching tools. I am
interested in learning how to use components of the math and literacy programs while staying true to my philosophy that interdisciplinary instruction is an important aspect of authentic, meaningful learning. Through inquiry-based-learning, I could focus on teaching a unit from the reading program about informational text as well as unit from the new math program about representing data visually. First, my students could explore exemplary models of informational text by a variety of authors. I would provide explicit instruction regarding how to use text features (glossary, captions, boldface type, graphs, timelines) to navigate and comprehend informational text. I could guide my students to incorporate a wider range of text features into their science notebooks, and throughout this process, I could also encourage my students to become proficient in interpreting visual data, such as graphs and timelines, and integrate these text features in their science notebooks.

**How can I encourage my students who struggle to use science notebook as tools to synthesize their thoughts?**

What can I do to encourage my students who struggle to develop efforts to evaluate data in order to make sense of their thinking? Throughout the study I noticed that Diane and Brayden were often focused on factual information and frequently looked to me to validate their direction. I would like to see my students learn to rely on their own interpretations to guide their learning. My future research could help me determine my students’ specific needs and how to support them. As part of a future study, I would like to examine how I might provide my reluctant students with additional explicit instruction and directions as well as increased time to think, write, communicate with others, and manipulate materials.
How might I support students’ ability to transfer expository writing skills to their creative writing experiences?

Developing as a writer of expository text is important for all students, but creative writing also plays an important role in the development of elementary-aged students. As indicated earlier, I have concluded that my students’ use of science notebooks enhanced their literacy skills, particularly in the area of writing. Throughout the study, I observed how my students also became more comfortable with the writing process—writing, revising and editing—through their practice writing about aspects of water. However, I am curious to learn how my students might transfer the skills they acquire in expository writing to creative writing, such as poetry or short stories. For example, as part of the current study, my students learned to sequence events, provide vivid details, and to communicate ideas clearly through writing. Perhaps in a future study I could explore the process of my teaching and my students’ learning related to the transfer of these skills into a writing unit about short stories.

Final Thoughts

In order to align to the Common Core State Standards, my colleagues and I adopted new curriculum programs in literacy—*Treasures* (Macmillian/McGraw-Hill, 2011) and mathematics—*enVisionMATH* (Foresman & Wesley, 2011). I faced the reality that some of my students were performing well below the expectations for the Common Core Standards for third grade. As a result, I began extending instructional time in literacy and math so that I could incorporate all the components of *Treasures* and
enVisionMATH. It was my hope that devoting more time to those two subject areas would have a positive impact on students’ academic progress. Consequently, I sacrificed science instruction and learning.

My goal for this research study was to explore how to effectively integrate the genre of expository writing and inquiry-based science through the use of science notebooks. Gilbert and Kotelman (2005) suggest that writing in science can significantly impact multiple dimensions of academic development because writing is a powerful thinking tool.

The design of my research study included a five-week inquiry based unit about water. Throughout the unit I supported my students as they developed as writers of three forms of expository text: procedural, descriptive, and explanatory. My students constructed deeper conceptual understanding of the content material through writing, which is evident in the findings and conclusions of my research.

I feel that I achieved my goal of enhancing my interdisciplinary teaching methods by implementing the science-writing approach. As a result, I created an environment in which students could explore their curiosities about aspects of the natural world while engaging in authentic writing and inquiry-based science experiences. The results of my research have led me to formulate new questions about the topic of writing in science, which I intend to explore as I begin a new school year. Fortunately for me, I will be moving with my students from third grade to fourth, and I will be interested to observe the ways in which my students continue to benefit from our experiences together.
References


