Spring 2016

Informational Writing for Research Using Common Core State Standards and Next Generation Science Standards

Jamie Litvinoff
University of Wyoming

Jamie Litvinoff

2016

INFORMATIONAL WRITING FOR RESEARCH USING COMMON CORE STATE STANDARDS AND NEXT GENERATION SCIENCE STANDARDS

By

Jamie Litvinoff

MS., University of Wyoming, 2016

Plan B Project

Submitted in partial fulfillment of the requirements
for the degree of Masters in Science in Natural Science in Middle Level Science from the
Science and Mathematics Teaching Center at the
University of Wyoming, 2016

Laramie, Wyoming

Masters Committee:

Dr. Ana Houseal, Chair
Dr. Jeff Lockwood
Dr. Amy Spiker

Abstract

The adoption of the Common Core State Standards (CCSS) and the Next Generation Science Standards (NGSS) by many districts may leave teachers feeling overwhelmed and anxious about implementing the required standards. Through careful and thoughtful planning, both the CCSS and NGSS can be combined to both relieve some of the pressure for the teacher and allow students to gain a deeper understanding to scientific concepts through the connection of writing. This mix-method action research project was conducted to show that CCSS can be supported by the NGSS in a second grade classroom. Students used argumentation and procedural writing to assist creating and carrying out the scientific practices of planning and carrying out investigations and engaging in arguments from evidence to validate claims. Students participated in three scientific investigations involving melting ice. Their final project included an open panel discussion regarding which type of salt melted ice in a tub the quickest. Students had to use their own data, observations, and research to validate arguments for their peers. The teacher unit analysis shows that the standards can be combined and taught simultaneously. Student data showed mastery of procedural writing and growth in the argumentation genre. It also showed a lack of ability at this age to record and analyze their data accurately. This research also highlighted concerns about the progression of the NGSS and its early practice of using argumentation with evidence and the CCSS lack of research in student writing, in particular procedural writing.

Dedicated to my family, my husband Chris, my parents Jim and Donna Kuhns,
and my son Nathan, you have supported and cheered me
on for six years while I followed my dreams

Acknowledgments

My first and greatest thanks goes to Dr. Ana Houseal. She is a model example of how to teach a student who is reluctant, lacks self-confidence, and needs persuading every step of the way. She has been my biggest cheer leader, not only in writing this paper and finishing my course work, but also professionally when no one else seemed to believe in me. I treasure the 6:30 am phone calls on Wednesday and will miss them when this chapter of my life ends. Thank you, from the bottom of my heart.

Secondly, thanks to Dr. Jeff Lockwood and Dr. Amy Spiker for their valuable input and guidance in designing my research three years ago. I am also grateful for the time they took to read my final piece and give input on how to improve and write clearly.

Third, gratitude is owed to my parents, who allowed me to stay with them every summer during SMTC classes, read numerous papers, bandaged my wounds after Botany trips, and cared for Nathan and my dogs for the past three years of writing.

A thank you goes to the nameless community that has become my home, the students who I have the honor of teaching every day, and their parents that I have come to know. Thank you to my principal for hearing about me “finishing” my paper for six years, and being excited now that the day is here.

Last to my husband, who helped me rearrange the house a multitude of times so I can have a working space, he allowed me to leave him for weeks to do classes, and he prayed for the day I would finish. My biggest blessing that came from this paper was our son. Two weeks after course work, he came into our lives with a phone call. Our lives have never been the same and have improved so much the past three years.

Table of Contents

List of Tables

Chapter 1

Introduction

"How can we teach science and all of the other standards too?" "My schedule is too demanding. I don't have time to teach science!" Do these comments sound familiar?

The demands on teaching all the content areas in elementary classrooms are intense and seem to become more complicated each year. As districts implement and adopt Common Core State Standards (CCSS), the time for teaching subjects such as Science, Social Studies, and Fine Arts seem to diminish. According to the Tienken and Orlich (2013) commentary,

> …within three to five years of having the CCSS and the accompanying high stakes national tests, we will see the students who do not meet the arbitrary levels of achievement set in those subject areas labeled "at risk" and forced to do more work in those areas, depriving them further of the opportunities to participate in other educational activities.(pg. 4)

One challenge elementary teachers face is the demanding curriculum standards that are now in place in many states. According to the CCSS, second grade has forty English/Language Arts (ELA) standards that must be addressed in one school year (CCSS, 2012). When added to the NGSS fourteen standards (NGSS, 2012) and the thirty-five Mathematics standards (CCSS, 2012) the mastery required by students seems impossible. The CCSS were written and developed first. The standards were created to be clear, understandable, and consistent among the states. They were also created using international models and aligned to meet college ready expectations (CCSS, 2016). The CCSS were designed to "The standards focus on core concepts and procedures starting in the early grades." (CCSS, 2016) The NGSS were created with a

Framework, then the progressions of skills and content knowledge for each grade level. Last, they were connected to the CCSS English Language and Math standards. With this connection, it might be possible for teachers to combine CCSS and NGSS in lessons in order to teach the skills necessary.

In an article written by Annemaria Palincsar (2013), the English Language Arts CCSS require a variety of challenging texts for students. She proposes that science texts are a way to meet that need. Also, the CCSS include standards of argumentation and using evidence for support. This begins as early as first grade with opinion pieces and progress throughout the elementary grades until the students begin to use evidence to support their argument or opinions (CCSS, 2016). The NGSS also uses the science practice of argumentation and data to support evidence (Palincsar, 2013). The NGSS have two parts. The first is the content standards that progress K-12. The second are scientific practices, including using evidence from data and observations in order to make an argument. The NGSS state specific links to the CCSS of opinion writing as a connection (NGSS, 2016). This study aimed to show that the links of CCSS and NGSS do not just include reading, but writing and presentation pieces as well. The research used particular matched standards from the NGSS and CCSS together; student learning increased and became more meaningful, while teacher stress was alleviated.

Statement of Problem

One problem primary teachers face is how to balance the demands of teaching English Language Arts and Mathematics standards, while trying to include science, social studies, and health instruction. The shift in instruction with the introduction of CCSS and NGSS might change how teachers present curricula. Instead of memorization and regurgitation of knowledge, students must apply their knowledge to new problems and in new contexts. One of the goals of CCSS was to reduce the number of standards taught, so students could gain deeper knowledge of specific skills (CCSS, 2016). However, students are required to apply their knowledge of the skills and use the skills in new ways. They also must engage in class discussions and use evidence to back up arguments (Hakuta, Santos, & Fang, 2013). Teachers not only have to teach curriculum, but offer the students experiences to apply, conduct discourse, and use evidence to teach the standards increasing the demands they face.

Another challenge teachers have with implementing standards, is the lack of professional development in teaching science and writing, implementing CCSS and the NGSS. In science, teachers need continued professional development opportunities and often feel more confident when provided with assistance in both content and strategies for teaching science (Michaels, Shouse, & Schweingruber, 2007). The prevalent part of implementing CCSS is the understanding of how it was written, how the standards were created, and how to implement them so instruction is effective (Jenkins & Agamba, 2013). Frequently writing instruction is composed of a combination of pre-service instruction, random staff development workshops, district demands, and personal pedagogical choices (McQuitty, 2012). In order for students to be successful in any of these areas, they have to be taught skills exclusively and purposefully (Troai & Graham, 2003). Each skill must be taught to the students because it is not innately understood without instruction.

Purpose

The purpose of this research was to understand and illustrate a way of integrating specific English Language Arts (ELA) CCSS standards and NGSS Scientific and Engineering Practices in order to increase student learning and reduce the teachers stress of covering so many standards. In order to do that, I had to understand the purpose of the CCSS and NGSS, the development of their designs, the "best practices" of science and writing instruction, and the science content that I presented to my students.

Since 2010, states have been actively adopting and implementing CCSS (Porter, McMaken, Hwang, & Yang, 2011). However, there is a lack of implementation of NGSS because they were released in the spring of 2013, just six months prior to this research project. I hoped one way that CCSS and NGSS could be used in combination for a fuller and deeper understanding of the research standards demanded by both. I also hoped to find instruction methods that would help to teach young students how to use research and improve their informational writing skills. Because of the nature of this research, the results could also help support the teaching of science in primary classrooms.

Research Question

The research question that guided this study was:

How can specific NGSS practices support the research and informative writing standards in the CCSS?

The purpose of the study is to use the specific Common Core State Standards:

- CCSS.ELA-Literacy.W.2.7 Participate in shared research and writing projects (e.g., read a number of books on a single topic to produce a report; record science observations).
- CCSS.ELA-Literacy.W.2.8 Recall information from experiences or gather information from provided sources to answer a question (National Governors Association Center for Best Practices, Council of Chief State School Officers, 2007)

Aligning the above CCSS with the following Next Generation Science Standards Practices of Science and Engineering:

- Practice 3 Planning and carrying out investigations
- Practice 4 Analyzing and interpreting data
- Practice 7 Engaging in argument from evidence

Chapter 2

Literature Review

Common Core State Standards

Since their creation in 2010, the Common Core State Standards (CCSS) have had huge influences on K-12 education. There are voices of support and criticism for the CCSS regarding: ways to implement the standards through professional development, how to use them for standardized testing, curriculum development, the amount of time on tested subjects (Tienken & Orlich, 2013, Jenkins & Agamba, 2013). The creation of CCSS has changed the ways curriculum companies write curriculum, there has been a shift in what standards teachers teach, and proposed change about how students are assessed.

The purpose of CCSS is to create a set of standards to be used nationwide rather than continuing to have disjointed, state-by-state standards (Porter, McMaken, Hexang, & Yang, 2011). The standards are presented with the focus of "what students should learn" and not "how students should be taught" (Porter et al., 2011). The creators of the CCSS wanted to establish standards that create the following practices in each state: shared expectations, focus, efficiency, and quality of assessments (Porter et al., 2011). Porter, et al compared the CCSS to more than twenty-five state standards. They found that many of the existing English Language Arts (ELA) state standards aligned with CCSS. However, the ELA standards written by the states were not as clearly written as the state Math Standards. The ELA CCSS were written specifically to focus on what students should learn.

The CCSS were designed to help create continuity within K-12. According to Jenkins and Agamba (2013) there are plans to develop pre-kindergarten and college undergraduate standards.

If that is the case, public schools will need to partner with universities to “unpack” the standards from the top down. Jenkins and Agamba also recommend that education university professors align their course work with 11^{th} and 12^{th} grade standards.

There has been criticism of the CCSS. According to the CCSS website, when designing the standards they were influenced by “top-performing countries”. This would allow American students to compete in a global society (2016). When Porter et al. (2011) compared the alignment and assessment data to international data that were available; they found that schools aligned to CCSS performed lower on the assessments than those in the other countries. The explanation for the low performance is the other countries focus on “performance-based” assessments and the states assessments still focused on memorization and recall. Other criticisms include the fact that there was not field testing or reporting of success and consequences in special populations, international comparisons, or assessments of the CCSS before their release (Tienken & Orlich, 2013). Tienken and Orlich claim that the education system is “being driven by ideology, rhetoric, and dogma instead of evidence.” Another concern Tienken and Orlich had is that the assessments for the CCSS were not written by the original CCSS writers. National testing began in 2014 and the possibility of test questions becoming the focus of instruction is very high. Some states, such as New Jersey, adopted the first version of CCSS and therefore 600 districts were using curricula that was not aligned because the standards were so new for example, Pearson Reading Street Common Core and MacMillan “My Math”.

There are also concerns that the amount of time focused on English Language Arts and Math will lead to a “determent of science, foreign language, arts and “non-core areas” (Tienken & Orlich, 2013). Cited in Tienken and Orlich, the most tested subjects (language arts and mathematics) will:

> Become the most important subjects in terms of time, and resources allotted to teachers. The opportunities students have to explore and delve into other subjects and educational activities, especially those seen as not academically challenging, will atrophy further. (pg. 6)

In other words, students who do not master ELA and mathematic standards will be pulled out of other classes and increase their time in language arts and math classes. Consequently they will have fewer chances in fine arts, social studies, and engineering classes with the possibility of finding their strengths or interests in the arts or other “non-core” subjects.

The last concern is the actual implementation of standards. Are teachers and pre-service teachers given enough professional development to handle the shift in education? If the idea of creating pre-k to 16 standards is to happen, then higher education will need to partner with classroom teachers to provide content knowledge and help increase student awareness that has consistent standards to the CCSS taught in school (Jenkins & Agamba, 2013). Professional development and teacher implementation are important; however a change in current professional development practices is difficult to show the link in teaching practices and to student achievement (Jenkins & Agamba, 2013). Jenkins and Agamba suggest effective professional development should focus the “teachers on what they should be teaching and the students learning what they should be learning” (pg. 72). According to Jenkins and Agamba (2013), “Teachers might be overwhelmed by multiple expectations originating from multiple entities” (pg. 73). These entities include building and district administrators, parents, the school’s community, and state expectations. The following professional development ideas are given by Jenkins and Agamba focus on content taught and methods used, give opportunities for active learning, consider duration of training (using follow-up trainings throughout the year, no one time shots), and align standards. They also recommend that a link needs to be found between current state standards and CCSS.

There is much to think about as states and districts implement the CCSS. Administrators need to consider how to implement CCSS and the skills their teachers need to be successful. It is important to find links between current state standards and discuss vertically between grade levels how to teach the skills needed to master the CCSS.

Next Generation Science Standards

In 2013, the National Research Council and The National Academy of Science released the revised and final version of the Next Generation Science Standards (NGSS). The NGSS were created with specific goals for instruction and learning. They simplified “Big Ideas” in each discipline while simultaneously focusing on scientific practices. However, there are some major challenges for educators and administrators to implement effective science instruction into classrooms.

The main purpose of the NGSS is to create integration and reinforce concepts across the fields to enrich and deepen students’ understanding (Wysession, 2003). The NGSS are correlated to grade-appropriate Common Core Math and ELA standards. The ELA standards are strongly connected with the NGSS through the Scientific Practices of *obtaining, evaluating, and communicating information* (Wysession, 2003). The ideal scientific education experience for any student is to begin learning these Scientific Practices in kindergarten and continue to build on concepts with appropriate sophistication through high school (Wysession, 2003). While progressing through school, students should also be given opportunities to build links to all of the scientific disciplines. The NGSS provide a scaffold of learning beginning in the primary grades.

The standards have key ideas that build as the students gain knowledge throughout their education (Krajcik, 2013).

Bybee (2011) also suggests by using the Scientific Practice presented in the NGSS, "activities become the basis for learning about experiments, data and evidence, social discourse, models and tools, and mathematics and for developing the ability to evaluate knowledge claims, conduct empirical investigations, and develop explanations" (pg. 38).These links and integration exposures are critical according to Krajcik (2013), "for learners to solve real-world problems and to further develop understanding" (pg. 8). If the vision of the NGSS is taught K-12, students will not only be shown the links among the disciplines but also be given the opportunities to link new knowledge and concepts with previously learned ideas. Krajcik (2013) explains:

Too often in science education, we have not systematically considered the prior knowledge of children to build deep and more connected understanding from Kindergarten to High School; to do so is critical to build understanding that can be used to solve problems (pg. 10)

Krajcik (2013) notes that the standards presented in the NGSS offer a multitude of experiences, but are also the central disciplines of science. For the purpose of this research only the Big Ideas for Physics and Earth Science were considered. The Big Ideas of Physics are: (a) blending of chemistry and physics; (b) motion and stability; (c) energy; and (d) waves and applications (Krajcik, 2013).

The Big Ideas of Earth Science are: (a) space and solar system; (b) interconnections between systems; (c) antrosphere system – with the goal to recognize the impacts and immense power our species has without moral judgment (Wysession, 20013). The Scientific Practices the NGSS focus on are:

1. Asking questions and defining problems
2. Developing and using models
3. Planning and carrying out investigations
4. Analyzing and interpreting data
5. Using mathematics and computational thinking
6. Constructing explanations and designing solutions
7. Engaging in argument from evidence
8. Obtaining, evaluating, and communicating information (NGSS, for States, By States, 2013)

For the purpose of this research, the literature review will focus on the Big Ideas of blending of chemistry and physics and interconnections between systems. The following practices will be used throughout the study: (a) asking questions and defining problems; (b) planning and carrying out investigations; (c) analyzing and interpreting data; (d) engaging in argument from evidence; (e) obtaining, evaluating and communicating information.

The NGSS do pose several key challenges for teachers and administrators. First, many science assessments ask students to recall memorized facts; a new approach is needed to assess science learning and connections between disciplines. Second, many teachers may be unfamiliar with engineering ideas and how to use technology effectively and appropriately. Third, teachers may be unaccustomed to teaching from a practice-based approach. Last, teachers may be unused to connecting science with overarching crosscutting concepts, with aspects of nature of sciences, Common Core Math and ELA standards.

Writing

Teaching writing can be a very difficult task. Often teachers do not receive enough instruction or professional development in effective writing instruction (McQuitty, 2012). The Common Core State Standards (CCSS) demand that teachers give opportunities for students to learn about and write in a variety of genres. For primary students, the writing might begin drawing illustrations, and present a finished product with electronic technology and a variety of media (Richards, Sturm, & Cali, 2012). In addition, there are many aspects of writing that have to be taught explicitly for the skill to be retained by the student (McQuitty, 2012). These skills include letter formation, spelling, and grammar.

Pre-service teachers are often required to take one course of Language Arts methods. However, after being hired, using trial-and-error they often employ a variety of experiences and theories to teach writing (Read, 2005). As a new teacher it might be difficult to decide which method, curriculum, and ideas to use to teach students. The strategies chosen may be based on classroom make-up, district policies, and school implementations. This causes teachers to create new pedagogies, whether they are effective or not (McQuitty, 2012).

Another difficulty for teachers to navigate is the many writing genres that must be taught. In primary grades, narrative writing is taught the most frequently (McQuitty, 2012). With the adoption of Common Core State Standards (CCSS), the amount of expository texts expected by students has increased (Richards et al., 2012).

Current writing research does offer some clear ideas to teach effective writing.

1. Students must be taught skills explicitly (McQuitty, 2012).
2. Students' writing experiences need to be authentic (Graham, 2005)
    a. Authentic experiences can be based on literature responses (Sloan, 2009).

b. Authentic experiences can be written collaboratively as a class (Wall, 2008).

3. Collaborative writing can lead to science discourse and discussion (Nolen, 2007), (Cavagnetto, Hand, & Norton-Meier, 2009).
4. Writing should make connections (Sloan, 2009).

These ideas are useful no matter what curriculum a district has implemented. The sections will describe the research on procedural writing and argumentative writing.

Procedural Writing

Procedural writing can be defined as having the purpose of enabling people can learn how to do things they do not know how to do. It should reflect the real-world, with authentic learning and writing. As with previous practices mentioned in this literature review, procedural writing characteristics must be explicitly taught to the students and modeled by the teacher. Procedural writing should identify a need or problem in the school or community, identify a solution, and provide steps to achieve that solution. The characteristics of this genre can be taught by looking at model texts, making lists of features, and focusing on how those characteristics help or hinder the reader (Juzwik et al., 2012). Thus teaching someone how to complete a task they did not know how to do.

There is very little written on this topic besides the book *Reading and Writing Genre with Purpose*. In the Common Core State Standards, it is only mentioned one time, in the first grade standards. There is insufficient research concerning the benefits of student learning or how to teach the genre effectively. I consulted with Dr. Victoria Gillis, a researcher in the field of Language Arts Education. She suggested reviewing the research literature on heuristic writing.

The connection to science for this genre would be science heuristic writing. According to the University of Iowa, scientific heuristic writing is a method to teach students to express their knowledge of science through posing questions, gathering data, and generating claims based on evidence. This should be done in place of memorizing facts and completing lab reports (Hand, 2016). This type of writing features interactive lab activities and discussions. It allows students to obtain deeper meaning from experimental data and observations (Burke et al., 2005). Through this writing, students are able to change their thinking concerning specific science understandings (Burke et al., 2005) and construct new understandings of the concept. As students become proficient at science heuristic writing, they become "experts" with a particular concept (Juzwik et al., 2012) and therefore, demonstrate a deeper understanding of the science (Burke et al., 2005).

Argumentation in Writing

Argumentation in writing takes a variety of forms depending upon the subject (Gillis, V. (2016, March 10) Email.) For the purpose of this research, argumentation is defined as, "an element of discussion and deliberation, and a combined effort to arrive at deeper understanding" (Smagorinsky et al., 2001:1) real-world phenomena using data as evidence to support claims (McNeill & Krajcik, 2012:3). Using argumentation in writing is very similar to persuasive writing, which is listed in some state standards. In the CCSS, persuasive writing is not a standard found in the elementary grades. The CCSS use opinion writing with supporting details from experiences and sources. The NGSS list second grade opinion writing as the connection to argumentation using evidence. This genre can be challenging for teachers to implement, but it engages student learning in a way not offered by other genres.

Persuasive writing often receives less attention in classrooms. It is analytic and uses evidence to communicate explanations (McNeill & Krajcik, 2012). Persuasive or argumentative writing also allows students to make connections between a variety of subjects, particularly

Language Arts and Social Studies, which is the focus of many CCSS. In the NGSS, students must use scientific explanations and evidence to support claims. This allows students to make a critical analysis of multiple explanations for the same phenomenon (McNeill & Krajcik, 2012).

There are challenges with teaching argumentation. Students often struggle with writing arguments (Smagorinsky et al., 2011). They are unable to use appropriate and sufficient evidence or consider alternative explanations to provide rebuttals (McNeill & Krajcik, 2012). Even with instruction of the elements of argumentative writing, students' writing may show the elements but not improve in quality (Malpique, 2016). As stated earlier, younger students do not understand how to analyze their data or the importance of recording it, so their claims may not have substantial evidence (McNeill & Krajcik, 2012). Teachers can help foster this type of writing and thinking in a variety of ways.

The research conducted by Smagorinsky et al. (2011) suggests using dialog before actual writing. The teacher should pose questions such as *why; so what;* and *who says*? These questions may help learners understand the requirements of arguments or discourse. As with other scientific and writing practices, scaffolding students throughout the process allows the students to achieve a higher level of performance in this complex practice (McNeill & Krajcik, 2012). Teachers might start with simple prompts and examples, and gradually increase the complexity of each argument. Using open-ended questions and hypothetical examples will refine understanding of content knowledge (McNeill & Krajcik, 2012). Students need to be taught the purpose and text structures of writing (Juzwik et al., 2012). The reason genres and text structures need to be explicitly taught is that students will not come to these conclusions on their own. Students should also find connections to every day examples, connect to other content areas, model and critique examples, provide feedback, engage in peer critique, and debate (McNeill &

Krajcik, 2012). Through scaffolding and increasingly complex prompts, students will be able to complete the steps to argumentative writing. They should be able to construct an argument that matters to them and might influence others (Smagorinsky et al., 2011).

In connection to science, argumentation allows students to understand scientific concepts at a deeper level. Instead of memorizing facts, students will have the opportunity to apply scientific ideas to answer a question or problem using evidence. The challenge of having to know, interpret, and use scientific ideas, requires students to really think and reason about phenomena (McNeill & Krajcik, 2012). This allows the students to apply concepts and evaluate others claims, thus increasing scientific understanding of the world around them.

Science Practice – Argumentation

Argumentation can be defined as the central activity scientists practice for the purpose of persuading colleagues of the validity of ideas (Duschl et al., 2007). Academic discourse or argumentation can also be presented in: descriptions of attributes, characteristic events, category comparisons, experimental ideas, results, final summaries, and explanations (Hoing, 2010). Nussbaum (2008) describes it as an explanation, or the truth of a conclusion that is accepted by participants.

Scientific discourse or argumentations differ from a debate because no sides have to be taken, and students are able to explore and change their positions on a topic (Nussbaum, 2008). Argumentation is not just the end of a science investigation or a way to wrap up a science unit. Argumentation and discourse serve a much higher purpose. In fact, Nussbaum states that this type of thinking skill is necessary in a democracy because it gives citizens the ability to think critically.

Scientific discourse not only offers valuable critical thinking skills, it also deepens understanding and allows students to promote conceptual understanding and deeper learning of content. In addition, discourse provides an opportunity for students to reconstruct their own knowledge (Nussbaum, 2008). While engaging in discourse, students are able to compare their viewpoints to the viewpoints of their peers. While using research or data to validate claims regarding a particular scientific concept. If students have a misconception, they may be able to identify it and fix it throughout the process. It is believed that argumentation "functions to strengthen the neural links representing these relationships and forges additional links with prior knowledge" (Nussbaum, 2007:352). However, this is not an easy process to implement. Just like planning and developing investigations, scientific discourse must be explicitly taught. Teachers must take the time to cultivate the environment and reflect specifically about the norms to implement scientific discourse in their science instruction. Teachers may also think argumentation creates tension and chaos in the classroom, but with correct implementation, it can do quite the opposite. Another reason teachers may shy away from using scientific discourse is because they lack the skills to manage the process or they are uncertain of its value (Naylor, 2003). Argumentation should be a collaborative process of peer interaction, which leads to deeper understanding of knowledge using suitable evidence (Naylor, 2003).

There are inconsistencies of analyses using argumentation with younger students. Naylor (2003) notes that argumentation might be difficult for primary students to engage in discourse because of their restricted language. In other words, it might be difficult for the students to communicate their ideas in the context of an argument. Whereas, Hoing (2010) supports utilizing discourse in the primary grades if students are supported and the language is modeled by the teacher. Students can be exposed to a variety of science writing and begin to practice the academic vocabulary needed to make an argument. Classroom environments need to be conducive to collaboration among students with specific norms set in place. It is important to teach students how to disagree politely (Nussbaum, 2008). When norms are in place, students will be able to construct and critique arguments (Nussbaum, 2008). Effective argumentation practices take place when a purpose has been set, students are engaged, and there is a clear connection to the curriculum and learning goals (Naylor, 2003).

Science Practice - Investigation

In recent science education reform efforts (from the 1980s forward), teachers have been encouraged to engage students in investigations in order to teach science. This way of teaching could evoke many feelings for both the teacher and the students of chaos, fun, and unconnected learning. However, teaching science using investigations should be purposeful and connected to standards and practices. Teaching students the scientific process through investigations should be explicit and has many benefits.

What is an investigation? According to *Taking Science to School* (NRC, 2007), investigations include asking questions, hypothesizing, and designing experiments. The scientific practice of investigation can also be described as a higher-level, critical thinking skill that students use to propose, support, critique, refine, justify, and defend their positions about a specific (sometimes controversial) scientific topic. Investigations should be purposeful and structured. They should lead to the formation of an argument using selected evidence in order to defend the claim (Llewellyn, 2013). In other words, students need to understand the purpose, be able to ask questions, create a measurable hypothesis, plan and carry out the investigation, collect evidence, and decide which evidence supports the claim for their audience. Investigations are the scientific practice that helps facilitate students' conceptual development (NRC, 2007).

Through investigations, teachers can identify student misconceptions, monitor their conceptual development, and teach scientific concepts. Included are the higher critical thinking skills most teachers strive to include in their instruction. Teaching students to investigate science does not come naturally. Students must be explicitly taught each step and how to "handle" the data collected from their investigation.

Similar to teaching writing, teaching students how to conduct science investigations must be explicitly taught through concrete experiences and teachers' prompts (Llewellyn, 2013). The first step in scientific investigation is asking a question. Questions must have a hypothesis in which one variable can be changed and measured. Children, especially in primary grades, tend to focus on plausible hypotheses and often get stuck focusing on a single hypothesis (NRC, 2007). In order for children to be able to understand the testable variables, to create hypothesis, they may need tools such as a chart or post-it notes to physically decide which variable to test in order to create a hypothesis (Buttemer, 2006). Once children can isolate the variable to be measured, they are able to create the hypothesis on their own.

Students need to collect data from measures, structure the data, and systematically document outcomes of the investigations (NRC, 2007). This becomes another moment for scaffolding, modeling, and independence for the teacher. Younger students are not able to understand the importance of a recording tool such as a notebook or chart. They believe their memory will be enough and often forget to record or use their notebooks when analyzing data (NRC, 2007). As a teacher of younger students, this should be at the forefront of planning in order to help students be able to collect enough pertinent data to support their claim.

Lastly, the investigation gives way to interpreting and evaluating the data, and using empirical results to develop and refine arguments, models, and theories. Students now may be able to formulate explanations from evidence and connect explanations to scientific knowledge (NRC, 2000). The practice of scientific investigation and its connection to scientific learning should be focused on the observable causes and effects that represent the “what “of natural phenomena (Zangori & Forbes, 2014). Students should be able to construct arguments and support their claims with the evidence from the investigation.

The NGSS and CCSS can be used concurrently to assist teachers in providing instruction in a variety of writing genres. With planning and preparation, the NGSS can work cohesively with CCSS by utilizing the Scientific Practices, specifically argumentation and investigation. It might be possible to reduce the stress on the educator while simultaneously deepening the students’ understanding of science through writing.

Chapter 3

Methods

Research Question/Introduction

The research question that guided this study was:

How can specific NGSS practices support the research and informative writing standards in the CCSS?

The purpose of the study was to use the following Common Core State Standards (CCSS):

- CCSS.ELA-Literacy.W.2.7 Participate in shared research and writing projects (e.g., read a number of books on a single topic to produce a report; record science observations).
- CCSS.ELA-Literacy.W.2.8 Recall information from experiences or gather information from provided sources to answer a question (National Governors Association Center for Best Practices, Council of Chief State School Officers, 2007)

And align them with the following Next Generation Science Standards (NGSS) Practices:

- 2-PS1-1 Plan and conduct an investigation to describe and classify different kinds of materials by the observable properties.
- P-S1-2 Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose.

2-PS1-4 Construct an argument with evidence that some changes caused by heating or cooling can be reversed and some cannot.

By combining standards into one project or group of lessons, this research investigates the thoughtful planning of the combined standards such that students would be able to learn more and ease the feeling of the teacher of having to teach these separately in the limited school year schedule.

Context of the Study

This study took place in a small town in a rural western state. The district is geographically large, and the school is located about eighty miles from the administration office and has its own principal, calendar, and advisory board. The community where Champion K-12 School (pseudonym) is located has very close ties with the school and the children are the focus of the community. The area where this school is located includes many ranches, four towns, and spans two states. The next closest towns are forty miles south and eighty miles north. The area's economy is composed of sheep and cattle ranching, oil and gas drilling, trucking, some residential and commercial, and service positions. Until recently there was no local doctor; therefore the community relied heavily on volunteer Emergency Medical Technicians (EMT) for medical care.

At the time of this study, Champion K-12 had around 184 students. Students typically start preschool together and graduate with the same core group of peers. There is a large focus on sports; however, the music and art programs are also expanding. Parents are typically responsive to teachers' requests and the school does not experience the many behavior issues a larger urban school might encounter. Champion K-12 does not qualify for Title 1, and is about 60-70% Caucasian, 29 – 39% Hispanic, and less than 1% African American. Class sizes range from 5 to 25 students, with one class per grade, and one teacher per subject.

Population

During the study, the 2nd grade class at Champion K-12 School was made up of seventeen students, ranging from seven to almost nine. There were eight girls and nine boys. The students' economic backgrounds varied considerably. Thirteen students were Caucasian and four were Hispanic. Two new students moved to town the previous summer. One student was identified as Special Education and had an Inclusion Aide for some subjects. The Inclusion Aide stayed in the classroom with the student and then helped the student on assignments given by the teacher. The student was in an alternative classroom for reading. In the study class, five students were labeled as "intensive" for reading, meaning that they perform below the fortieth percentile on District tests. Three were considered "strategic", meaning that they score between the fortieth and fiftieth percentile, and the other nine were at "benchmark", meaning they perform above the fiftieth percentile.

Data Collection

In this mixed methods action-research study data were collected in two ways. First, lessons were video recorded and these recordings were used to observe students during lessons, recall questions and reactions, to help reflect on each day's lesson. Second, student journals were used to monitor understanding, misconceptions, and questions. Students' final projects, which consisted of a poster and notes for their debates, were used to show how students synthesized concepts learned in the unit and potentially to the next. As stated in the IRB, student work was kept in a secure location. Also students' names were changed during the discussion portion of this paper in order to maintain anonymity.

While I watched the videos and analyzed student work, a table was created to show trends and patterns of students' discussion and question. I chose four of the seventeen students to watch based on how verbally they communicated during the video recorded sessions. This allowed me to collect specific data and not have to infer the answers of students who did not talk frequently. I realize by collecting my data based on the students who talked more, that my conclusions do not equally represent the population of the class. If conducted again, I would specifically find ways to record the data from the many groups of students in the study.

Documentation Instruments

Three spreadsheets were created to document student reactions throughout the study. The first spreadsheet was created to monitor class discussions and responses for the video recorded lessons. The second was to record specific answers from the four children and their written work. The last spreadsheet was used to analyze the writing and science units and verify that the research question was fulfilled during teacher instruction.

Limitations

One limitation from the data collection was faulty video equipment. Due to the amount of recordings needed and the lack of knowledge on how to run the equipment correctly, there was not as much video to analyze as first envisioned. Also, it did not seem to capture student responses as well as I would have liked. The unit was taught at the end of the year during a lot of transition time. Students were in and out several times throughout the lessons. If it were taught again, I would conduct the research during the winter, when school activities are reduced.

The second limitation was the lack of completed student work and the missing recorded conversations. Originally, the plan was to analyze all seventeen students' work and conversations throughout the study. However, as I began to analyze the student work and videos, and discovered that a number of students were absent frequently, their work was not complete, and their comments did not record well on the video portions of the discussion. Because of this, four students were chosen for this deeper analysis. The four students chosen for this now mixed methods action research case study based on the amount of recordings they were involved in, having completed work and final presentation pieces. The four students chosen were average learners, each with unique strengths and weaknesses that will be discussed in Chapter Four.

Summary Activities - Science Lessons

On the first day of the unit (Appendix F), I set the purpose for the unit. This was done by asking, “Why is it important to keep the ice off of roads?” The students brainstormed ideas of keeping car safe, preventing accidents, and not damaging roads. I asked, “What kinds of materials or tools can be used to keep the ice off roads?” Students responded with sand, salt, mud, shovels, and snow. After that I introduced the investigation and explained to students that they will create investigations to show which material melts ice more effectively and be able to share that with professionals in the transportation department.

Students had previous knowledge of the process of scientific investigation. They knew to include the question, hypothesis, materials, procedures, data, results, and conclusion for their investigations. Students did not understand why only one variable could be manipulated and the importance of keeping other variables the same. This was the purpose for the second day’s lesson (Appendix F). I provided each group of students with a tub of ice. The tubs did not have equal amounts of water in them, and the students could choose where to place the tubs. The students were asked to write a hypothesis, “Which group’s ice melted the quickest?” Students wrote their hypothesis in groups and included rationale of why theirs would melt the quickest. Then students measured the melted water every 20 minutes and recorded the data on a table provided by the teacher. After a day of measuring, the students shared their data. It was very apparent that the tubs did not contain the same amount of water. The mixed results led to a discussion of the importance of ensuring all, but one variable was the same while conducting science investigations.

On the third day of the unit (Appendix F), students had to plan their own investigation. The question presented to the students was, “Which material will melt ice more effectively?” The students were able to use sand, salt, or sugar as the material to test. In groups students had to determine the following variables: (a) how much water will be melted; (b) how much of each material will be tested; (c) where the tubs of ice would be placed; (d) how often to measure; and (e) whether the lids would stay on or off. Students recorded materials used and the procedures for conducting the experiment. I gave students the tables for recording their measurement data.

After conducting the experiment and recording data, I led a discussion about what to do with the data. I explained that data had to be in a form that other scientists and people can read. The class discussed the various forms in which this data could be shared. Some examples shared by the students include: the actual data table, pictures of them measuring the water after it melted, writing an email to a classmate, or a graph. I taught a lesson (Appendix F) on how to create a line graph with three lines. First, the students shared with the class the elements that needed to be included on the graphs. These included a title, numbers on the sides, numbers on the bottom, and a key. Together with adults, each group created their own graph to represent their data. Once graphs were created, a discussion could begin about how to use data to validate an argument.

I set the ground rules or norms for the process of argumentation. The students were reminded that scientists share their results in many ways (conversation, reports, presentations, and in journals). Then I began modeling several true claims along with false claims using evidence from data. Students began to make claims about their data and shared those claims with the class. I asked students what would happen if someone made a false claim or a claim with very little evidence. Students discussed and concluded that the investigation could and should be repeated in order to validate the claim with evidence.

Summary of Activities - Writing Lessons

Procedural writing. This writing unit (Appendix E) started with the class and I looking at examples of procedural writing texts. These texts were displayed on the SmartBoard® and the teacher made a list of the text structures of each book. The texts used were retrieved from an online reading resource called *Reading A-Z*, which includes leveled reader books from pre-readers up to 6th grade. The book levels were selected to vary from late first to late third grade.

The class identified the following text structures that made "good" examples of this genre of writing.

1. The book needed an introduction and purpose for making the item.
2. The purpose was clear and gave reasons or history of why this item was made.
3. A "good" book included pictures and explanations of the final product.
4. The book should list the materials needed and the class really liked books with pictures of those materials.
5. The book gave clear directions and included hints or tips if needed.
6. The book ended with a conclusion that encouraged the reader to try their new item.

In order to model procedural writing, the students wrote a "How to Make Valentine's Boxes" essay. The students had not written this type of genre before and needed a model to help solidify the new skill. Students had to include the text structures they identified in the other books. They had to state a purpose for making the Valentine's boxes. The students also had to draw their final draft of how their box would look. They also had to include the materials and draw pictures of what they used. Materials ranged from shoe boxes to milk jugs. Students could use tissue paper, ribbons, stickers, glue sticks, doilies, and construction paper. As students created their boxes, they had to write the steps they completed for their boxes. Students soon found that five steps were not enough for describing the process. They also found that their boxes were different than the final product they predicted.

During the following weeks, students created a “published book” using procedural writing. As a class, the students dictated their ideas on “How to” topics that were appropriate for their age. The topics had to be doable by the age group and they had to be able to create enough steps to fill the published book template provided by *Student Treasures*. These templates were fourteen pages long and included cover pages, a dedication, text, and illustrations. Students wrote their procedural writing on the template. Finally they transferred their ideas with illustrations to a copy of the final draft template. The published piece was not necessary for the research, but added to the experience of learning the genre.

Although the published books were created with some independence, I felt that a completely independent writing assignment was needed to show mastery of this genre. Students had to write an essay on “How to Catch a Leprechaun” using a leprechaun trap. Students used their imaginations to catch the leprechaun. I was able to see at a glance if students understood procedural writing. Students then used their procedural writing skills to complete a Science Fair Project in April and to plan the investigations in the unit used in this project.

Summary of Activities - Argumentative/Persuasive Writing

Argumentation/persuasive writing was taught at the same time as the Science Unit. While the students had mastered the purpose of procedural writing, now they had to construct an argument with evidence using their data from science. This new genre is not used in the primary grades on an individual basis very often, but it is modeled as a whole class assignment with the teacher.

As a whole class, we discussed the purpose of persuasive writing (Appendix E). The discussion led to the types of papers or essays that would be appropriate for persuasive writing. The class brainstormed ideas for topics and the brainstorming filled the whiteboard and took one day to discuss. On the second day, with teacher guidance, students added an audience to each idea. For example if the idea was to buy new playground equipment, then the audience would be the principal. If the idea was to go on vacation to Disneyland, the audience would be the students' parents.

Students picked one topic from the board. Using this topic, they wrote a persuasive paragraph to the chosen audience. This unit was taught in the spring of the students' second grade year. A paragraph, at this level, is defined as one topic sentence, three key ideas, and a conclusion. If able, students add explanations, specific examples, or more details to their key ideas. Second grade students often needed guidance and teacher help writing the topic and concluding sentences. In order to get a baseline for this genre, I gathered a quick writing sample from the students. This assessment took one writing class. (See Appendix I for the template used.) Students were very reluctant to write in this new genre, and required a considerable amount of help. Five students worked with an inclusion aid to get specific instruction, sentence by sentence. Since these five students had struggled throughout the year to convey their message in writing, this was not unexpected. I collected the writing samples and graded them using a rubric.

In order to model the new genre, I had two examples of writings regarding animal crossings (Appendix E). The two examples persuaded readers that creating animal crossings above or below highways, people and animals would be safer. The students and I looked at both pieces and together created a list of text structures to include in a "good" persuasive writing piece. The students identified that it was important to know who wrote the text, why the text was written, and who the audience was. Identifying the audience was very challenging and took several minutes to guide the students through the lesson with many "how do you know?" prompts.

The next step was modeled writing. As a class, we wrote a paragraph describing why it was not good to cheat. The students chose the topic because it was an issue that had caused a lot of turmoil in the class. The entire class identified the purpose of the paragraph and the audience. Students listed the pros and cons of cheating, so the paragraph had both sides of the issue. The paragraph concluded with a stance on why cheating was unacceptable. This modeling technique seemed to clarify the expectations for the persuasive writing component.

The final assessment for the students was to write a second paragraph using the same text format as the class created piece. Students could rewrite their first piece or choose a different topic. More students found success the second time, but it was concluded that this was a difficult genre for second graders to master.

The writing standard 2W2.8 "Recall information from experiences or gather information from provided sources to answer a question" was used in connection with the NGSS scientific and engineering practice, *construct an argument with evidence*. Students had to use their evidence throughout their own projects to construct an argument. I introduced the problem of ice not melting on the highway (Appendix F). Students discussed the hazards of the road if the ice stays on the highway. In groups, students had to study the amount of time it takes different types of salt to melt ice in ice trays. From their conclusions and research about the cost of ice, students had to create an argument for the best type of salt to use on the roads. The specifics of these lessons are discussed in the previous science section.

The final assessment of this genre was the student presentations of their findings. The students held an open debate about their findings. They had to answer and ask questions of other groups and from the audience. All opinions had to be based on facts from their research.

Final Project

The final days of the unit were spent on the final project (Appendix F). This project included skills from both the writing and science units. Students had to plan and conduct and investigation answering “Which salt melts ice most effectively?” The investigation included all of the steps of the scientific process, as well as, research about the different salts that were available.

In groups, students decided which salt to use and how much to use. They decided where they were putting their ice trays and how often they would check the measurements. Students recorded their data on a table provided by the teacher and then used that data to create a graph. The teacher provided extra information about each type of salt, including how it was made, its availability, an estimated cost, and any effects it had on the environment. Students then created presentation posters that included their hypothesis, their procedures, and their data table. They also wrote a paragraph that provided evidence from research and data about the best salt to use to melt ice on roads.

In order to practice the argumentation of the unit, students conducted an information panel for elementary students, staff, and parents. The students then used their boards and data to make claims about the best salt to use, ask questions to other groups, and answer questions from the audience.

Chapter 4

Results

Introduction

In order to answer the research question, "How can Next Generation Science Standards support the research and informative writing standards in the Common Core State Standards?" I collected the following data sets - (a) a teacher analysis of the unit, (b) student analysis of four students, and (c) a collection of general observations from the class. Data were collected using video recordings, analyzing student work, and analyzing the teacher unit.

Data Analysis – Teaching Unit

The goal of the research was to teach the specific writing standards of CCSS which are participate in shared research and writing projects (2W2.7) and recall information from experiences or gather information from provided sources to answer a question (2W2.8). In conjunction with the science and engineering practices of plan and conduct an investigation (Practice 3), analyze and record data (Practice 4). During four out of five procedural writing lessons, only writing standards were addressed. The only activity that involved a science standard was during the final presentation. During the final presentation, both writing standards were taught in conjunction with the scientific practice three, which describes planning an investigation.

The argumentation writing lessons required eight sessions to teach. During the eight sessions, three of the sessions combined the W.2.7 writing standard and the science practice of constructing an argument using evidence (Practice 3).The other five lessons combined three or more standards in order to teach the argumentation genre of writing.

Table 1

	CCSS.ELA-W 2.7 Participate in shared research and writing projects	CCSS.ELA- W.2.8 Recall information from experiences of gather information from provided sources to answer a question	NGSS 2-PS1-1 Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties	NGSS 2-PS1-2 SEP #4 Analyzing and interpreting data	NGSS 2-PS1-4 SEP #7 Engaging in arguments from evidence
Procedural Writing – Pre-teaching	X	X			
Procedural Writing - Teaching of text structure (Valentine's Day)	X				
Procedural Writing – "How to Book"	X				
Procedural Writing – guided projects	X				
Procedural Writing – final project	X	X	X		
Argumentative Writing – class brainstorm of topics	X				X
Argumentative Writing – identifying the audience	X				X
Argumentative Writing – Pre-assessment	X				X
Argumentative Writing – class paragraph	X	X			X
Argumentative writing – group project purpose	X	X	X	X	X

Table 1 continues on the next page.

	CCSS.ELA-W 2.7 Participate in shared research and writing projects	CCSS.ELA- W.2.8 Recall information from experiences of gather information from provided sources to answer a question	NGSS 2-PS1-1 Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties	NGSS 2-PS1-2 SEP #4 Analyzing and interpreting data	NGSS 2-PS1-4 SEP #7 Engaging in arguments from evidence
Argumentative writing – group project research		X	X	X	
Argumentative writing – final project	X		X	X	X
Argumentative writing - presentation	X	X	X	X	X

The writing argumentation lessons and science investigation lessons were taught consecutively throughout the day. The number of standards taught on Day four and five, were significantly less than other days. Those particular days were focused specifically on analyzing data and teaching the students how to graph. On day five, the only standard addressed was science practice three. On Day six, when students were learning how to make claims, only two scientific practices were addressed. For the majority of the science lessons, three to five of the science and engineering practices were used to teach students how to create an investigation, collect and analyze data, and make valid claims based from these data.

Table 2

	CCSS.ELA-W 2.7 Participate in shared research and writing projects	CCSS.ELA- W.2.8 Recall information from experiences of gather information from provided sources to answer a question	NGSS 2-PS1-1 Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties	NGSS 2-PS1-2 SEP #4 Analyzing and interpreting data	NGSS 2-PS1-4 SEP #7 Engaging in arguments from evidence
Science Day 1/2 – Background knowledge and discussion		X	X		X
Science Day 1/2 – Unfair experiment		X	X	X	X
Science Day 3 – Make a question					
Science Day 3 – Group hypothesis		X	X	X	
Science Day 3 – Procedure of experiment					
Science Day 4 – Conduct experiment	X	X	X		
Science Day 4 – Collect data				X	
Science Day 5 – Share results (discuss patterns, compare data, discuss inconsistences)			X	X	
Science Day 6 – Make claims based on data		X			X
Science Day 6 – Introduce argumentation		X	X	X	X
Science Day 7 – Design the salt experiment	X	X	X		
Science Day 8 – Conduct salt experiment and recording data	X	X	X	X	X
Science Day 9/10 – Research salts to make claims on best use	X	X	X	X	X
Science Day 11 – Panel Disc.	X	X	X	X	X

As the Tables 1 and 2 show, during multiple lessons three to five of the Common Core Standards and NGSS science practices were taught simultaneously in order to provide a deeper conceptual understanding of the material. However, this does this research did not show student mastery in using the scientific practice, so additional data needed to be collected.

Data Analysis – Student Group

In this case study, four students were chosen based on the following criteria: students who had complete work, they were audible throughout the video recording, and did not miss any of the lessons in the unit. Their names have been changed to preserve anonymity. Also, no data were collected during the procedural writing portions on individual students because it was completed prior to the approved IRB date.

Milly. Milly was a high level learner and is often relied upon in class by her peers. She was a conscientious worker and aimed to be perfect even at as a second grade student. During the introduction of the argumentation genre lessons, Milly struggled with finding the audience to match the specific topic. For example, on the topic of "helping a classmate or neighbor" and "helping soldiers" she identified the audience as the community, but was unable to identify how the community could help. After the discussion of the audience for her group's writing piece, Milly seemed to understand the idea of audience. She was able to help other groups identify the audience as a dad or contractor for fixing faulty playground equipment and give the example of a fundraiser to raise the money to do so.

During the science lessons, Milly identified that the class' water amounts were not the same and because of that, the initial investigation was not fair. She was also able make the connection that the variable involving water in the following experiment had to be equal in order for data to be collected. When data were collected from the second experiment with salt, sand,

and plain water, Milly's graph was complete using marginally unclear information; she used the same color for two lines. During the final investigation, Milly identified that her calculations might be incorrect and circled them in on her data table to show that she was unsure of the water melt-off totals. Milly's group's final project claimed that rock salt was the best salt to use on the roads. Her graph showed the data correctly. She also concluded that rock salt was cost efficient and readily available.

Thalen. Thalen was an average student and considered to be a leader by his classmates. He also worked hard, but did not enjoy writing lessons. During the argumentation lessons, Thalen did not participate much and relied on his table partner and an adult to help answer the questions. However, during the modeled writing lessons, Thalen participated in the discussion about why students should not cheat offering answers and identified the principal or teacher as the audience of the topic. During the science discussion after the first investigation, Thalen identified the water amounts were not the same because his group had the smallest amount of water. He also noted that in following investigations, water levels would be the same for all groups. During the second investigation of materials, Thalen's data chart was the most complete and he also summarized some of the results. However in Thalen's final project, his data were very unclear. On his graph the mill salt actually reduced the amount of water melt off and the lines went the wrong way. His group identified iodized salt as the best salt to use because it was the cheapest, melted quicker than mill salt, and it helped people.

Skylar. Skylar was an average learner and very verbal in group discussions. He was excited about learning new things, especially in science and he enjoyed group projects and class discussions. During the argumentative writing introduction, Skylar did not identify the audience of any of his group's topics. His group required help from other groups in order to identify the audience for any topic. However, Skylar identified the importance of fair variables in the initial investigation. He was one of the few students that also recognized that the tubs of water were different shapes and would be the same for each group. During the second investigation, Skylar's graph was completed and accurate; this did not happen on his final project. During his final project, Skylar's data table had few measurements recorded. Also the group used only 900 mL of water but the water measurements when totaled were 1,100 milliliters.

For some reason, Skylar's group did not finish their final poster, so it was unclear which salt they claimed was the best for melting ice off of roads.

Mack. Mack was a struggling student with a health impairment that affected his speech and communication skills. Mack enjoyed science, but struggled with writing assignments. He helped others in class and was considered by the others as the kindest student. In the argumentative pre-assessment, Mack was one of the very few students able to construct an argument, giving evidence why it should happen, and suggested steps for it to be accomplished. During the next class discussion, he was able to identify the audience for a few topics. During the first investigation, Mack identified different variables other than the water level. He stated that some groups had their lids off while others had lids on. He also was concerned that groups were able to put their water tubs in many locations instead of just one. During the discussion, Mack also stated that he thought everyone had the same amount of water, even though several students had shared that before. During the second investigation, Mack's data table appeared incomplete and his graph was unclear. His sand measurements decreased, while his other measurements increased. Mack's final project appeared to have been completed with help from an adult. In his final argumentation paragraph, he stated that iodized salt was the best because it was cheap, melts faster, and helped people.

Conclusion

Students' knowledge about the process of creating an investigation and using evidence to make claims increased throughout the unit. Their original investigation with water helped them understand the importance of variables and how it is important to only change one. Students had multiple experiences making line graphs all year, and it was assumed that they would be able to transfer their knowledge of graphing to this unit. Students did not increase their mastery of collecting and graphing data. However, students were able to make arguments using their research and own investigation observations. Mastery was not only measured by their completed work, but included the confidence shown by the students during the final presentation, in comparison to the frustration demonstrated during the writing pre-assessment.

Chapter 5

Discussion

Findings

The purpose of this study is to show how Next Generation Science Standards Practices can support the research and informative writing standards in the Common Core State Standards. Two major connections between science and writing are evident. First, students were able to use their knowledge of procedural writing to write and carry out scientific investigations. Second, students were able to construct an argument using data and research. In both instances, more than two of the four Common Core standards and NGSS practices were addressed at a time throughout the research unit.

The first claim this research supported was that students were able to use their knowledge of procedural writing to write and carry out scientific investigations. After learning the text structure, and having a variety of exposures to writing in this genre, students were easily able to set up their own investigations during the science unit. As supported by the research, the students were not able to easily pick one variable to manipulate without teacher assistance. Although the students seemed to understand procedural writing texts, it is unclear if they were successful compared to others of the same age groups, research in the same area, and research with teaching this genre. Students could not be compared to other studies because there are no studies completed in this writing genre.

If this study had involved science heuristic writing, the teacher would have allowed for time and began modeling how to use argumentation and checked for student learning of the scientific concept each were studying. This research focused on students being assessed on their ability to plan and conduct their own investigation. There is no research connecting procedural writing to scientific writing. The two genres seem to have different purposes, even though the textual structures are similar.

The second claim that this research supported was that students would be able to construct an argument using data and research. During the initial writing assignment, many students were able to produce at least four sentences in their persuasion paragraphs. However, they were not able to give specific reasons to support their topic. Before the writing unit, they were not able to use evidence from their world to support their topic. After the unit, students were able to look at the data and create claims using the data as evidence. In the initial investigation, using general observation and simple measurements, students identified that different amounts of water were used and that did not allow for valid claims about the "best place to melt ice".

After the second investigation, students were able to identify salt as being a better material to melt ice than sand and sugar. They relied on observations instead of data tables. This validates the research in *Taking Science to School,* that young students do not value recording data, therefore it is not available to make claims. In addition, during the class discussion, students were able to make a hypothesis for the final investigation about which salt would melt ice the best.

For the independent and final investigation, students recorded their data and participated in researching the different types of salt. With teacher guidance, students were able to identify availability of salt types, environmental impacts, and the cost to use salt for one storm on 100 miles of highway. Using this information, and identifying the audience as Transportation Department officials, students were able to present sound arguments for which salt was the best to use. During open discussion, the majority of students referred to their data table, graphs, or notes to answer questions or validate their claim. Students respectfully listened to each presentation and asked questions that were relevant to the study. Students were also able to answer questions from the audience of peers and teachers. **Discussion**

During the unit, a lack of teaching planning and predicting was identified. For example, students needed assistance with creating a questions and hypotheses for the first investigation. When this study began, based on their science fair projects, students were considered to be proficient at completing the steps of the scientific model as related to that type of project to the point of making a conclusion based on measurement comparison data. For example, they could compare lengths of paper airplane flight, or the amount of time to freeze water. They could not however, create their own questions and corresponding hypothesis, which was predicted and explained by NRC (2007). The research reports that young students are not able to do this independently. After the first lesson of “fair or not fair”, the class had to create an investigation about melting ice. When asked to develop questions about which melts ice more effectively, students would respond with different types of salts and sugars instead of only one variable at a time. Examples of some of their questions included, “Would pink salt or blue salt melt ice faster?” “Would sugar and salt mixed melt ice faster than brown salt?” This is evidence that supports the research that primary students are not able to identify that only one variable should be changed at a time. After recording several types of questions that were similar, the students had to be redirected, and modeled the type of question that could actually be investigated in a classroom. In order for students to understand the idea of changing one variable, they may need the opportunity to manipulate their ideas using slips of paper or post-it notes. A physical movement or organization of their ideas may also be helpful. This will allow them to physically categorize which variables will not change and which variable they will manipulate during their investigation. (Buttemer, 2006).

Another finding during the investigation process included a discussion about which measurement unit to use for dry materials. In science, the metric system is used. For liquids the class used milliliters. However, when it came to measuring dry ingredients, for example, salt, sugar, or sand, the teacher did not have access to tools to assist with the measuring. Even if the tools were available, at second grade, students do not understand what a gram equated to. At that point, the students were instructed to use cups for the unit of dry ingredients; this created a combination of metric and customary systems. This is concern cannot be alleviated using the CCSS measurement standards because students do not learn about the metric system until third grade. A current district theory is after statewide testing, teachers begin teaching the standards for the next grade. Since this research took place in May, this would have been an opportune time to introduce grams to the students.

A third challenge for this research was the lack of student-recorded data for each investigation. As a class, the students decided to record measurements for water melt-off every 30 minutes. The students were given a data table to record these results. After the first investigation, I discovered that either the data tables were incomplete or the adding of measurements was inaccurate. Many of the graphs were incorrect because the data were not correctly recorded. The students were reminded to record their data; this issue is consistent with the research written by NRC (2007). Also, the math skill of adding and subtracting multiple digit numbers could have played a role in the mistakes.

When it came to making the graphs, this was a challenge in itself. Students had been taught all year how to read and create simple graphs. However these graphs were limited to less than three lines for data. It was very difficult for them to label their graph even when modeled. The teacher tried to explain to the class how to label the graph; it might have been easier if it was modeled visually. However, the data of each group was so varied; it would have been difficult to do so for each group.

During the second investigation using a variety of salts, students recorded their data on the white boards, so the teacher could help monitor what was recorded. I discovered that some students had difficulty reading the beakers for accurate measurements or they would forget how to add two and three digit numbers correctly. Students also struggled monitoring their answers and the measurements for accuracy. For example, if only 500 mL of water was used, some students did not understand how a total of 893 mL of water melt-off was inaccurate. Many graphs were left incomplete for the final project.

Teaching students the norms and procedures of argumentation was more difficult than predicted. A pre-assessment was suggested by a university professor (Kamberellis, G. February 2014, personal communication). In the first pre-assessment, six students were incapable of completing the task. They were pulled out with an instructional aid and given guidance to complete each sentence. The next day, students were able to identify situations, problems, or tasks that they could write about. Some example topics are: cleaning up litter around the school, going to the movies, getting a pet. The class spent another 45 – 60 minutes determining the audience for each topic. Even with this amount of structure, it was very difficult to complete the paragraph. These struggles with argumentation confirm the research described by McNeill and Krajcik (2012) demonstrating students are unable to use appropriate and sufficient evidence without teacher modeling (McNeill & Krajcik, 2012).

Research supports this type of teaching. Smagorinsky, Johannessen, Kahn, and McCann (2011), suggested using dialog before actual writing may help learners understand the requirements of arguments. In following with the research, my students created an argumentation paragraph together as a class. Together they discussed the consequences of cheating and why people should not cheat. This was a topic of passion for many of the students and had instant engagement. From there, the students were able to construct an argument using a graphic organizer and previous experience.

Teacher Implications

If I were to teach these lessons again, I would change a few things. First, I would eliminate the second investigation of "which material melts ice more effectively?" Most students through discussion had agreed that salt melted the best. This would have allowed for students to spend more time focusing on the final presentation. Second, I would teach this in the winter. By the time my unit was written and was cohesive, it was May. There was one very cold day and the rest of the time it was in the 70s. I think salt melting ice would have had a more dramatic flair in the winter. Third, I would spend additional time teaching and modeling data and graphing. I would also find a way to make the data table easier for struggling students to complete.

Implications for Research and Further Questions

There are three implications for further research because of this study. First, was the use of the NGSS practice of argumentation using evidence developmentally appropriate for second grade students? Second, will the lack of data building and manipulation in the Common Core State Standards create a deficiency in science data analysis for elementary students? Third, what are the benefits and best teaching practices for the procedural writing genre?

The CCSS do not specifically use the word "evidence" until fourth grade. In the previous grades, students are expected to identify details from informational text in order to answer questions or discuss the text. In contrast, the NGSS partner the CCSS reading informational text standard "Ask and answer such questions as *who, what, where, when, why*, and *how* to demonstrate understanding of key details in a text." They also connect to the opinion writing in second grade stating, "Write opinion pieces in which they introduce the topic or book they are writing about, state an opinion, supply reasons that support the opinion, use linking words (e.g., *because*, *and*, *also*) to connect opinion and reasons, and provide a concluding statement or section (CCSS, 2016)." Is the expectation of "engaging in argument from evidence using prior experience in order to compare ideas" (NGSS, for States, By States, 2013) too high for primary grades? The current research is contradictory. Hoing (2010) supports argumentation in the younger grades if modeled by the teacher. Whereas Nussbaum (2003) states concerns that children that young may not have the language necessary for argumentation.

The second implication for research is the data piece of scientific investigations. This piece is crucial because it supports whether the hypothesis was supported and if not, why. Students need to understand how data helps them evaluate their argument as valid or not valid. In this research, students collected measurements of three liquids throughout the day. The CCSS, state a very basic variation of collecting data. The second grade standard is, "Draw a picture graph and a bar graph (with single-unit scale) to represent a data set with up to four categories. Solve simple put-together, take-apart, and compare problems[1]using information presented in a bar graph (CCSS, 2016, 2.MD.D.10)." Other elementary grades do not have standards that require measuring and representing data more complex than the second grade standard above. In fifth grade, there is not a representing data standard at all. Should this representing data in graphing only be taught in science? How complex of data should primary students represent and how should the data be presented?

The last research implication is procedural writing. This genre is only mentioned one time in the standards at a first grade level. Second through fifth grade CCSS mention it in the Reading Informational Text standards, specifically "describe the connection between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text (CCSS, 2016, RI.2.3)." I could not find any research about this before 1980. Some questions about this genre that could yield interesting research studies include: What are the benefits and advantages for students to learn this genre? Besides the connection to writing scientific investigations, what other connections are there? How is procedural writing relevant to student achievement? Why should teachers instruct students how to write this genre? Are there more efficient way to teach procedural writing than others?

Conclusion

There are numerous standards for teachers to get through in one year. Most school districts now have adopted CCSS for teaching language arts and mathematics. Many school districts have adopted the NGSS to guide educators in teaching science. There does not seem to be time to get still teach everything, and the task of doing so is daunting. However, with careful planning and thought, teaching these standards together can not only ease the load, but also benefit students. Through connecting the standards, students are able to learn concepts with deeper conceptual understanding of many subjects instead of just memorizing and forgetting a few facts for each subject.

References

Ahtee, M., Juuti, K., Lavonen, J., & Suomela, L. (2011). Questions asked by primary student teachers about observations of a science demonstration. *European Journal of Teacher Education, 34*(3), 347. doi:10.1080/02619768.2011.565742

Akkus, R., Gunel, M., & Hand, B. (2007). Comparing an inquiry-based approach known as the science writing heuristic to traditional science teaching practices: Are there differences? *International Journal of Science Education, 29*(14), 1745-1765. doi:10.1080/09500690601075629

Beers, S., & Nagy, W. (2011). Writing development in four genres from grades three to seven: Syntactic complexity and genre differentiation. *Reading and Writing, 24*(2), 183-202. doi:10.1007/s11145-010-9264-9

Buttemer, H. (2006). Inquiry on board. *Science and Children, 44*(2), 34. Retrieved from http://search.proquest.com/docview/236897450

Cavagnetto, A., Hand, B. M., & Norton-Meier, L. (2010). The nature of elementary student science discourse in the context of the science writing heuristic approach. *International Journal of Science Education, 32*(4), 427-449. doi:10.1080/09500690802627277

Duschl, R. A. (2007). *Taking science to school*. Washington, DC: National Academies Press.

E. Michael Nussbaum. *Collaborative discourse, argumentation, and learning: Preface and literature review q* doi:10.1016/j.cedpsych.2008.06.001

Gillam, D. (2012). *A framework for K-12 science education: Practices, crosscutting concepts, and core ideas*. Washington: National Science Teachers Association. Retrieved from http://search.proquest.com/docview/1036930489

Glen, N., & Dotger, S. (2013). Writing like a scientist: Exploring elementary teachers' understandings and practices of writing in science. *Journal of Science Teacher Education, 24*(6), 957-976. doi:10.1007/s10972-013-9348-x

Graham, S., Harris, K. R., & Mason, L. (2005). Improving the writing performance, knowledge, and self-efficacy of struggling young writers: The effects of self-regulated strategy development. *Contemporary Educational Psychology, 30*(2), 207-241. doi:10.1016/j.cedpsych.2004.08.001

Hakuta, K., Santos, M., & Fang, Z. (2013). Challenges and opportunities for language learning in the context of the CCSS and the NGSS. *Journal of Adolescent & Adult Literacy, 56*(6), 451-454. doi:10.1002/JAAL.164

Honig, S. L. (2010). A framework for supporting scientific language in primary grades. *The Reading Teacher, 64*(1), 23-32. doi:10.1598/RT.64.1.3

Jenkins, S., & Agamba, J. J. (2013). The missing link in the CCSS initiative: Professional development for implementation. *Academy of Educational Leadership Journal, 17*(2), 69. Retrieved from http://search.proquest.com/docview/1368620481

Krajcik, J., & Merritt, J. (2012). Engaging students in scientific practices: What does constructing and revising models look like in the science classroom? *The Science Teacher, 79*(3), 38. Retrieved from http://search.proquest.com/docview/1000411241

Burke, K.A., Hand, B., Poock, J., & Greenbowe, T. (2005). Using the science writing heuristic. *Journal of College Science Teaching, 35*(1), 36. Retrieved from http://search.proquest.com/docview/200382270

Keeley, P. (2013). Is it a solid? claim cards and argumentation.(formative assessment probes). *Science and Children, 50*(9), 26. Retrieved from http://search.proquest.com/docview/1401105904

Krajcik, J. (2013). The next generation science standards: A focus on physical science. *Science and Children, 50*(7), 7. Retrieved from http://search.proquest.com/docview/1324444243

Llewellyn, D. (2013). Making and defending scientific arguments: Strategies to prepare your students for the new wave of curricula reform. *The Science Teacher, 80*(5), 34.

Malpique, A., & Veiga-Simão, A. M. (2016). Argumentative writing by junior high school students: Discourse knowledge and writing performance / escritura argumentativa en alumnos de secundaria: Conocimiento sobre el discurso y rendimiento en la escritura. *Infancia Y Aprendizaje, 39*(1), 150. doi:10.1080/02103702.2015.1111609

McNeill, K., & Krajcik, J. (2012). *Supporting grade 5-8 students in constructing explanations in science; the claim, evidence, and reasoning framework for talk and writing. (DVD included)*. Boston, MA: Pearson. Retrieved from http://search.proquest.com/docview/906485199

McQuitty, V. (2012). Emerging possibilities: A complex account of learning to teach writing. *Research in the Teaching of English, 46*(4), 358-389. Retrieved from http://www.jstor.org/stable/41583590

National Governors Association Center. (2016). Common core state standards initiative. Retrieved from http://www.corestandards.org/ELA-Literacy/

Naylor, S., Keogh, B., & Downing, B. (2007). Argumentation and primary science. *Research in Science Education, 37*(1), 17-39. doi:10.1007/s11165-005-9002-5

NGSS Lead States. (2013). Next Generation Science Standards: For states, by states. Washington, DC: The National Academies Press.

Nolen, S. B. (2007). Young children's motivation to read and write: Development in social contexts. *Cognition and Instruction, 25*(2), 219-270. doi:10.1080/07370000701301174

Olinghouse, N., & Wilson, J. (2013). The relationship between vocabulary and writing quality in three genres. *Reading and Writing, 26*(1), 45-65. doi:10.1007/s11145-012-9392-5

Porter, A., McMaken, J., Hwang, J., & Yang, R. (2011). Common core standards: The new U.S. intended curriculum. *Educational Researcher, 40*(3), 103-116. doi:10.3102/0013189X11405038

Read, S. (2005). First and second graders writing informational text. *The Reading Teacher, 59*(1), 36-44. doi:10.1598/RT.59.1.4

Sloan, G. (2009). Northrop Frye in the elementary classroom. *Children's Literature in Education, 40*(2), 120-135. doi:10.1007/s10583-008-9070-z

Smagorinsky, P., Johannessen, L. R., Kahn, E., & McCann, T. (2011). *Teaching students to write argument*. Portsmith, NH: Heinemann.

Richards, S., Sturm, J.M., & Cali, K. (2012). Writing instruction in elementary classrooms: Making the connection to common core state standards. *Seminars in Speech and Language, 17*(2), 130-145. Retrieved from https://www.thieme-connect.com/ejournals/abstract/10.1055/s-0032-1310313

Graham, S., Harris, K.R., & Mason, L. *Improving the writing performance, knowledge, and self-efficacy of struggling young writers: The effects of self-regulated strategy development* doi:10.1016/j.cedpsych.2004.08.001

Tienken, C. H., & Orlich, D. C. (2013). Translating the common core state standards. *AASA Journal of Scholarship & Practice,10*(1), 3.

Wessels, S. (2013). Science as a second language: Integrating science and vocabulary instruction for English language learners. *Science and Children, 51*(1), 50.

Wysession, M. E. (2013). The next generation science standards and the earth and space sciences: The important features of earth and space science standards for elementary, middle, and high school levels. *Science and Children, 50*(8), 17.

Zangori, L., & Forbes, C. T. (2014). Scientific practices in elementary classrooms: Third-Grade students' scientific explanations for seed structure and function. *Science Education, 98*(4), 614-639. doi:10.1002/sce.21121

Appendix A

Parental Consent (English/Spanish)

General Purpose of the Study:

You are being asked to allow your child to take part in a research study. This document has important information about the reason for the study, what your child will do during the study, and the way I would like to use your child's information.

The purpose of this study is to find the link between the Common Core State Standards and Next Generation Science Standards. The study will look specifically at the teaching of informative writing that uses research, definitions, and evidence to support student claims.

Procedure:

The study will take place in the 2nd grade classroom [redacted] Eighteen students from ages 6 – 9 will participate. Three classroom aids will also be in classroom to help in their normal roles. The study will be conducted in the same way as normal classroom instruction that happens in the 2nd grade classroom.

[redacted],, the 2nd grade teacher will be conducting the study. The students will continue normal classroom procedures for science investigation. These include: observations, asking questions, writing in science journals. Students will also conduct normal writing procedures. They will conduct research to answer their questions and use evidence to support their conclusions. These activities happen on a weekly basis in [redacted] classroom. Students will participate in a maximum of 5 hours a week for four weeks. Students will participate in the study for 3 – 5 weeks with sessions lasting no longer than 60 minutes. This is a normal span of a science unit.

Data will be collected by classroom observation, video recording of class lessons to record teaching and student learning, collection of student and teacher journaling, student writing samples, and other student work samples.

Disclosure of risks:

Student subjects are at minimal risk during participation. One risk is anxiety from the tasks and writing process. Students may also breech confidentiality by talking to others. The researcher will do her best to make sure the breeches of confidentiality are minimal. These risks are similar to the risks that may take place in a normal 2nd grade classroom.

Other risks might include students sharing information about the study with other children and adults outside of the classroom. However, this information should not affect the study. Student participation will not affect their grades. Students will not be treated differently for participating or not participating in the study.

Description of Benefits:

There are not any direct benefits for the students participating in the research.

The indirect research benefit is the student participants' teacher will improve her teaching and understanding of Common Core State Standards, Next Generation Science Standards, the writing process, science journals and student research Student participants might benefit by learning the process of research and begin building a foundation for better informative writing and research.

Confidentiality:

Student subjects will not be identified by name, appearance, age, and gender. Pseudonyms or codes will be used to protect student identity. All student work will be kept in a locked file cabinet in a locked classroom. Research and student work with specific student names will only be shared with [redacted] faculty advisors.

Data will be stored on a password protected computer and in a locked file cabinet and in a locked classroom. Any codes used to identify students will be kept separate from student work. Data will be stored for no more than 3 years and then destroyed. Only the Primary investigator and faculty supervisors will have access to data. The PI or project director shall maintain in a designed location, the signed informed consent forms and the written research summary, relating to research which is conducted for at least three years after completion of the research.
Data will only be used for this particular study.

Freedom of consent:

Student participation in this study is voluntary. The refusal to participate will not have any negative effects on the students' grades. If students do not participate in the study, their work or data will not be used as part of the research. Students will not be treated differently for participating or not participating in the study.

Students may end participation in the study with a verbal statement to the researcher. Parents may also withdraw their children from the study by a verbal statement. Students who withdraw from the study will not be treated any differently than students in the study.

Questions about the research:

The principal investigator can be reached at the following address:

[redacted]

If you have questions about your rights as a research subject, please contact the University of Wyoming IRB Administrator at 307-766-5320.

Parental consent required for all subjects under 18 years of age:

As parent or legal guardian, I hereby give my permission for (child's name)
___________________________________ to participate in the research described above.
(printed name of participant)

____
Printed name of parent/legal guardian

____ ______________________
Parent/legal guardian signature Date

Consent of audio and video recording:

Lessons during the study may be recorded for teacher reflection.

_____ Yes, my child can be recorded during lessons.

_____ No, my child may not be recorded during lessons.

Parental Consent in Spanish

El propósito del estudio:

Estamos pidiendo que dejen que su hijo/a participé en un estudio. Este documento tiene información sobre la razón para el estudio, lo que va estar haciendo su hijo/a durante el estudio, y la manera en que yo voy a usar la información de su hijo/a.

El propósito del estudio es para encontrar la correlación entre las Normas de Asignaturas del Estado y las Normas de la Próxima Generación de Ciencias. El estudio va a ver específicamente a la enseñanza de escritura informativa que usa, definiciones y la evidencia que suporta todas las reclamaciones que pueden ocurrir.

Procedimiento:

El estudio va a tomar lugar en el salón del 2º grado en la escuela de [redacted] Dieciocho estudiantes entre la edad de 6-9 van a participar. Tres ayudantes de salón también van a ha estar en el salón para ayudar en el capacito normal. El estudio va hacer conducido en la misma manera del salón como siempre ocurre en el salón de 2º grado.

[redacted], la maestra de 2º es la que va estar conduciendo el estudio. Los estudiantes van hacer todo normal en el salón para la investigación del estudio. Esto incluye observaciones, preguntando preguntas, escribiendo en cuadernos de ciencia. Los estudiantes también van a conducir normal con sus procesos de escritura científica. Ellos usaran investigaciones para contestar sus preguntas y evidencias que suportan sus conclusiones. Estas actividades serán cada semana en el salón de la [redacted]. Los estudiantes participaran en el estudio por 3-5 semanas con las secciones no más de 60 minutos. Esto es lo normal para una sección de ciencias.

Datos serán colectados por observaciones en el salón, grabaciones de video serán hechas para ver la enseñanza de la lección y de como aprenden los estudiantes, la colección de escrituras hechas por los estudiantes y la maestra y otros ejemplos de trabajos hechos por los estudiantes.

Riesgo de revelaciones:

Los estudiantes están en muy poco riesgo de que algo pase durante la participación. El único riesgo será ansiedad de las tareas y el proceso de escritura. Los estudiantes también pueden quebrar la regla de confidencialidad y platicar con otros. La investigadora tratara de hacer lo mejor posible para que esto no suceda. Los riesgos serán los mismos que pueden ocurrir en cualquier salón de 2º año.

Otros riesgos que pueden ocurrir son que los estudiantes pueden dar información del estudio con otros niños y adultos fuera del salón. Sin embargo, esta información no tendrá efecto en el estudio. La participación del estudiante no va a afectar sus grados. Los estudiantes no van ser tratados diferente si participan o no participan en el estudio.

Descripción de beneficios:

No hay ningún beneficio para los estudiantes en participar en este estudio.

El beneficio indirecto de este estudio es que la maestra del estudiante va a mejorar su estilo de enseñanza y va tener una mejo comprensión de las Normas de Asignaturas del Estado y las Normas de la Próxima Generación de Ciencias, y los procesos de escritura, cuadernos científicos y mejor conocimiento de como aprenden los estudiantes. En el proceso de como buscan información para asistir en los fundamentos para mejor escritura e investigaciones en trabajos.

Confidencialidad:

Los estudiantes no serán identificados por nombre, apariencia, edad o género. Seudónimos serán usados o códigos para proteger la identidad de los estudiantes. Todo el trabajo del estudiante será mantenido en un armario que estará atrancado en el salón que también será atrancado cuando nadie esta en el salón. El trabajo y todos los conocimientos con el nombre de los estudiantes solo serán compartidos con los profesores de la maestra [redacted].

Los datos del estudio serán guardados en una computadora con una contraseña en un armario en el salón. Todos los códigos usados para identificar los estudiantes estarán separados de otros de trabajos que hagan los estudiantes. Los datos serán mantenidos por tal vez tres años, formas de consento y cualquier otro papel relatado será mantenido todo junto durante este tiempo tambien.

Los datos solo van hacer usados para este estudio.

Libertad de consentimiento:

La partición el estudio es voluntario. Al rechazarse de participar no tendrá ningún efecto negativo en los grados del estudiante. Tampoco serán tratados diferente por habido participado o no participado.

Los estudiantes pueden parar de participar en el estudio con simplemente diciendo verbalmente que y no quieren participar. Los padres también pueden hacer lo mismo cuando ya no quieran los estudiantes que sigan en el estudio. Los estudiantes que salen del estudio no serán tratados diferentes que los que siguen en el programa.

Preguntas sobre la investigación:

La investigadora principal puede ser contactada ha la dirección que sigue:

[redacted]

Si tienen preguntas de sus derechos como sujeto de la investigación, por favor hablen a la Universidad de Wyoming al IRM administrador al 307-766-5320.

Consentimiento de padres para todos bajo de 18 años de edad:

Como padre o guardia legal, yo doy mi permiso para (nombre de estudiante) ________________________________ para participar in el estudio que esta describido anteriormente. (Escrito claramente el nombre del estudiante)

_________________________________ Nombre del padre/guardia legal escrito

_________________________________ _________________________

Asignatura del padre/guardia legal Fecha

Consentimiento para grabar en video o de audio:

Las lecciones pueden ser grabadas durante el estudio para que la maestra tenga oportunidad de reflejar en lo que enseño ese día.

__________ Sí, mi hijo/a pueden ser grabados durante las lecciones.

__________ No, mi hijo/a no puede ser grabado durante las lecciones.

Appendix B

Student Assent Script

General purpose of the study ***(Title not to be read to students)*****:**

My name is [redacted]. I want to tell you about a research study I am doing. A research study is usually done to find a better way to treat people or to understand how things work. In this study I want to find out more about teaching writing and science together.

[redacted]***: I want to tell you about a research project I am doing for my class. A research study is done to find a better way to treat people or to understand how things work. My research will help me find out more about teaching writing and science together.***

Procedure ***(Title not to be read to students)*****:**

We will conduct the study in our classroom. I will be doing the study by collecting your work, recording our lessons and journaling with you. Our science and writing classes will be the same. We will ask questions, make predictions, make observations, and write our findings. We will also do some research to backup our claims. We will do this for about an hour a day for four weeks.

[redacted]***: Here is how we will conduct the research. First, we are going to do some investigations about melting ice. You will ask and answer questions in a notebook. You will write down the things you will observe and want to know more about. This is no different than our normal science class. During writing time, we will work on writing pieces that explain our experiments. We will also do research on why the ice is melting. This is no different than our normal writing class. The only thing that will be different is I will collect your notebooks, research notes, and writing pieces for my class. You will not get to take these things home. I will then look at them and share with my teachers what you learned and how I can improve my teaching.***

Disclosure of risks ***and Confidentiality*** **(*****Title not to be read to students)*****:**

A risk is something that may cause stress and frustration. One thing that may cause stress is the writing tasks. We will work together so you will not feel stressed or frustrated.

Another risk might be with confidentiality. Confidentiality is keeping someone's name and work private. I and my professors are the only ones that will see your work with your name on it. No one else in the school or town will know which work is yours.

You may feel excited to share what we are doing in class. In this case, we cannot share these exciting events, because it will break confidentiality.

[redacted]***: Because this is a research project, we have to talk about our class a little differently. Our research has to be confidential. Confidential is almost like a secret. The only people that will see your work are my teachers and me. When I write about your observations, I will only describe you as a student. I will not share your name, how old you are, or if you are a boy or girl. I will also use a code or pseudonym, a fake name, to describe your work. I will keep your codes and names in a separate place, so no one can figure out your***

work. Your work will also be kept in the locked classroom and on my computer which is protected by a password. This will keep your work confidential.

Our words must be confidential too. You will not be able to share with students that are not in our classroom. It is very important that we do not tell other grownups or children about our science and writing research. Your parents, [redacted] ***know that we are doing research and they have agreed to be confidential as well.***

~~**Description of benefits:**~~

~~There are no direct benefits for you participating in this study.~~

~~The indirect benefit is that I will understand teaching writing and science, which makes me a better teacher.~~

~~**Confidentiality:**~~

~~I will not use your name, age, or gender in my final paper or when I share your work. I will use a code or pseudonym, a fake name, to describe your work. I will keep your codes and names separate.~~

~~Your work will be kept in the locked classroom and on my computer which is protected by a password.~~

Freedom of ~~consent~~ *assent (Title not to be read to students.)*:

~~I know that I am volunteering (doing this on my own) to be in this study. I know that if I don't participate in the study then I will not be in trouble with~~ [redacted] ~~and I will not get a bad grade. I know that I can stop participating by telling~~ [redacted] ~~or another grown-up helping in the room.~~

[redacted]***: It is your choice if you would like to participate in the study. Participate means to be a part of, in this case, it means to share your work with me and giving me permission to describe and use your work. Your parents already gave permission for me to ask, but now you have the choice of giving permission for me to use your work.***

If you choose not to participate, you will still get to do the science and writing in class. I will not be mad or sad if you do not participate. You will not get a bad grade. If you choose to participate and then change your mind, you just have to tell me. Then I will not use your work as part of my research.

Questions about the research (*Title not to be read to students)*:

~~If you have questions about the research study, you can talk to~~ [redacted]~~. Here is her contact information:~~

[redacted]

[redacted] ***You may have questions about the research as we continue. You can talk to me at recess or leave me a note on my desk.***

If you or your parents have questions about participating and I can't answer the question you can ~~If you questions about your rights as a research subject, please~~ contact the University of Wyoming IRB Administrator at 307-766-5320.

Appendix C

Sample Questions used throughout the study

Sample Questions to be used before and during student observations of matter:

- How are material A and material B similar? How are they different?
- What do you predict will happen if you heat or cool the water?
- What do you predict will happen if you add salt/sugar/food coloring?
- What could you do know that you have…?
- Would your results be different if you…?

Sample Questions to be used by teacher after observations:

- What caused the water to...?
- What will you research to support your conclusions?
- What tools will you use to research?

Sample Questions to be used by students during discussion and discourse:

- What evidence supports your conclusions?
- What would you suggest for a next step?
- How would you change your experiment if you did it again?

Appendix D

Permission Letter from Building Principal

Name of School
Address
Town, State Zip Code

September 17, 2013

To Whom It May Concern:

I am writing this letter to inform you that Jamie Litvinoff has my permission to complete all aspects of her research project at NAME OF SCHOOL. If you have any questions or need more information, please do not hesitate to contact me by phone at (XXX)XXX-XXX.

Sincerely,

Mr. Principal of School

Appendix E

Writing Unit Plans

<table>
<tr><th>Procedural Writing</th><th>Argumentative/Persuasion Writing</th></tr>
<tr><td>
Pre-teaching
1. As a class analyzed several texts for text structure and elements.
2. As a class identified that “good” procedural writing had the following elements:
a. Introduction including why someone would want to do the said topic.
b. Picture or explanation of final project
c. Materials with pictures
d. Clear directions with hints/types as needed.
e. Conclusion
3. Followed a book step-by-step and made notes of text structure.

Teaching
1. Students made lists of possible “how to” topics.
2. In small groups, students chose three topics that were realistic and in which they were experts of.
3. Students then outlined the materials and procedures needed to accomplish the task.
4. Students chose a topic to write and filled out a template to complete the task.
5. Students then published a book from their rough draft.

Assessment
Students wrote a short “how to” piece explaining how to catch a leprechaun.
</td><td>
Pre-teaching
1. Whole Class: Why do we need persuasive writing? What kinds of things/events/issues/ would be appropriate for persuasive writing?
a. As a class brainstorm some issues/events that the students could write about.
2. Planning the audience
a. For each item discuss possible audiences. Record in the list.
3. Pre-Assessment:
a. Students will pick an issue to write about. They may choose to write a letter or a paragraph.
b. The teacher will assess the current level of students’ writing and how they are able to communicate persuasively.
Teaching
1. Model texts – introduce a variety of texts to students that persuade people to change. Include letters, petitions, brochures, posters, ads, public service announcements, proposals, grants, Power Points.
2. While reading texts as a class, answer the following questions:
a. Who wrote the text?
b. What was the text regarding?
c. Why was it written?

Model Writing
1. Develop ideas about what makes good persuasive text and promotes the outcome effectively:
a. Clearly defined topic
b. Good reasons for changing things
c. Ways to involve the audience
d. Effective pictures/data
2. Teach (using example texts and modeling)
</td></tr>
</table>

	structural characteristics: a. Compelling opening b. Explication of content c. Counterarguments d. Qualification/Constraints e. Conclusion 3. Teach (using example texts and modeling) language characteristics a. Direct address b. Question for reader or listener c. Logical Links d. Qualifiers 4. As a class, write a persuasive piece about why cheating is not honest. While writing the teacher will model the pieces above. 5. Students will be given the choice to edit their pre -assessment or to choose a new topic to write about. 6. Students should show a beginning understanding of how to write persuasively. 7. Students will work with peers, adult helpers, and teacher to monitor progress, edit, and revise pieces. **Introduce Writing connected to Science Unit** 1. Why is the topic relevant? a. Why is effective ice melting important to you? What are the effects of bad road conditions? How do icy roads affect you? Where else is ice an issue? b. What could be done to melt ice on roads? How can the roads/surfaces in winter be improved? c. Who would you write to make these changes? What would you say? 2. Who is the audience? a. Guide/lead the discussion to custodians for sidewalks, head of the maintenance department, WYDOT/CDOT engineers, superintendent, and business manager. **Creating the Writing Piece** **Prewriting**: 1. In science groups students will decide the

	following: a. What is the persuasion? What variables could be compared to make a difference in melting the ice off of surfaces? b. Does research need to be done to become experts and to get the facts? c. Which chemicals will your group use to compare? What are the costs of the chemicals? Are there environmental impacts to using this chemical? d. How will your group present? Will it be a letter, a PowerPoint, using a poster? Should all the groups present the same way? e. What should be included in the presentation? What text elements need to be included? How will you know you have enough evidence to persuade your audience? **Writing/Assessment** Students will work in groups to write and create presentations. They will use the evidence gathered from the science experiments. They will research costs and environmental impacts for the types of salt they use. Students will have pictures and data from their experiments to include in their presentations. **Presentations** Students will write invitations to custodians, head of the school maintenance department, WYDOT/CDOT engineers, superintendent, and the district business manager to attend presentations. These guests will have already been invited by the teacher. Students will present their findings to the honored guests and take questions from the audience.

Appendix F

Science Unit Plans

Title: Water/Matter	**Grade:** 2	**Length:**

Step 1: Content

Question: What can be used to clear ice from roads?

Big Ideas

Different kinds of matter exist and many of them can be either solid or liquid, depending on temperature. Matter can be described and classified by its observable properties. (PS1.A)

Scientific Practices

Main Focus: Construct an argument with evidence to support a claim (2-PS1-4)

Other Practices: Analyzing data with progress to collecting, recording, and sharing observations. (2-PS1-2). Make observations to construct an evidence-based account for natural phenomena(2-PS1-3)

Crosscutting Concept: Cause and Effect

Students learn that events have causes that generate observable patterns. They design simple tests to gather evidence to support or refute their own ideas about causes.

Understandings:

All materials are made of matter whether they are visible (solids & liquids) or not visible (most gases).

- Water can be observed in all three states of matter.
- Water can change (?) from one phase to another due to heating or cooling, or interactions with chemicals or other materials.

Scientists make claims using evidence from collected data and observations.

Scientists review each other's claims (peer review) for completeness or validity.

Knowledge

- Matter has three stages.
- Adding heat or taking heat away can cause changes in matter.
- Water can be melted using other substances.

Vocabulary

matter, phases (solid, liquid, gas), water, melting,
procedure, investigate, evidence, claim, argumentation

Assessment

- Formative Assessment:
  - Students' reflections in daily journals/wrap up.
- Summative Assessment:
  - Students' presentations to answer questions.
  - Students' questions to other groups using evidence to support claims in argumentation.
    - Students will argue why, based on evidence, that some materials are more effective in melting ice than others.

- Skills to be observed
    - Using vocabulary correctly
    - Understanding the three phases of matter.
    - Writing observations and data.
    - Using data and evidence to support any claims or conclusions.
    - Sharing evidence and asking questions with peers.

Each lesson will be about 50 minutes, with an option of 30 additional minutes the next day.

Day 1- 2

Introduce Question: What is most effective at melting ice on the roads?

Background Knowledge:

- Discuss winter roads and why they are treacherous when they are icy.
- Make a list of why clearing the roads of ice in winter is important.
- What is the difference between snow covered and ice covered roads?
- Make a second list of what students have seen as effective products for de-icing roads.

Introduce the problem:

Explain to students that their job will be to present evidence to a WYDOT engineer on what is the most effective way to clear ice off a road. The students will conduct experiments and do research (in a form of interview) on the best materials that melt the ice off the road.

Describe to students that they will conduct experiments like scientists. Scientists ask a question, make a guess/hypothesis, conduct the experiment, and then study the results. After they study the results they make claims (suggestions, papers, presentations) using their evidence.

Initial experiment:

Give each group a pie pan of frozen water. Each pan will have a different amount of water. As a class, decide where to put the pans to melt the ice. Throughout the day, each group will pour off the water and measure it.

The groups will record their measurements.

As soon as the water has melted in all the pans, have students share their data with the class.

Questions during data collection

- How much water did your group have in its pan?
- Using data, which groups' ice melted the fastest? How can you tell?
- Would there be a better experiment design?

Fair/Equal Discussion

- What made this experiment fair or not fair?
- Was each group's data equal? In other words, can we use everyone's data and share the results?
- How can we make design the experiment so that each group is equal?

Wrap-up Discussion

- If we give each group the same amount of water, what could we use to measure how fast the ice melts?
- Do the ice pans need to be in the same place to measure melting? Why?

Student Journal Reflection

- Did our first experiment have equal results?
- Was it easy or difficult to compare all the groups' data? Why or why not?
- If our class wanted to measure how fast water would freeze, what steps do we need to take to make sure the results are equal?

Assessment:

Video Review:
The teacher will review the experiments that day to address any misconceptions, misuse of vocabulary, and create any follow-up questions to help guide students.

Student Journal:
The teacher will review student responses in their journals to assess the use of evidence based claims.

Day 3

Question: How can we design an experiment to test which materials melt ice the quickest?

Introduction

- Review the previous day's lesson about fair and equal.
- Review the steps scientists use to conduct an experiment.
    - Ask a question
    - Make a guess (hypothesis)
    - Plan the experiment
    - Measure the results
    - Share the results – presentation, writing, conversation
    - Ask more questions
- Explain to the students that today, they will begin designing their experiments to see which materials melt ice the quickest.

Designing the Experiment:

- As a class, create the question. Lead students towards "What material will melt ice quickly/effectively?"
    - Discuss effectively.
- Introduce the materials that will be used: sand, salt, and sugar.
- Have each group create their own hypothesis.
- The teacher will review the materials used in this experiment.
- As a class, discuss the method of the experiment – the step by step procedures.
    - Address amounts of water, melting materials, time in melting, how often the trays will be measured, and location of trays.
    - Students will record these on their lab sheets.

Wrap-up Discussion

- Tell students that we will set the experiments up in the morning. Tonight the trays will be placed in the freezer to become ice.

Student Journal Reflection

- How did we insure that our experiment is fair?
- What is your group's hypothesis? Why did you choose that material as the most effective?

Assessment:

Student Journal:

The teacher will review student responses in their journals to assess the use of a fair experiment.

Day 4

Introduce Question: What material is most effective at melting ice on the roads?

Introduce how to record data and measure for results

On Smartboard, show the data table that the students will be using.
Point out each column: time, amount of water for each tray (plain, sand, salt, sugar).
Review the measurement used (mL).
Show how to pour water into beaker.

Begin Experiments

Have students place trays in designated areas.
Measure melt-off throughout the day and record results in the table.

Student Journal:

Write a summary of your results. Which material melted the ice more effectively? What evidence can you use to prove your claim?

Assessment:

Video Review:
The teacher will review how students measured melt-off and how they record results.

Day 5 - 6

Question: How can we analyze data and use it to make claims?

Sharing Results:

Each group will record results on the whiteboard. As a class, compare data and record it on the Smartboard. The teacher will help the students process their data and put it in a graph so the results can be discussed.

After the data is recorded talk about the patterns they see. Discuss their hypothesis in comparison to data. Begin modeling evidence based claims.

Using evidence to make a claim/Argumentation

Remind students that scientists share their results in many ways (conversation, reports, presentations, and in journals). How could they share these results?

Begin modeling claims (several true) using evidence from the data. Ask students to make claims in their groups. Then share out to the class.

Ask students what they think happens when scientists make false claims or claims without evidence or very little evidence.

Introduce the term "arguing". Discuss that is not personal arguing like with a sibling, but professional to question someone's claims because they misinterpret the evidence or have very little evidence to support their claim.

Display a chart with created measurements that can be used to make claims. Make a claim using the evidence with one graph. Encourage students to begin the arguing process. Set up class protocols for appropriate behavior and words during this time.

Practice these protocols with the created data.

Wrap-up Discussion

Ask students if they know how people melt ice using salt? Is it all the same? Are there different kinds?

Explain the Homework:

Students will need to ask 1 – 2 people how they melt ice at home or at a business. Students can ask parents, relatives, community members, and the custodial staff.

Student Journal Reflection

- What did our class data show as the most effective material to melt ice? What is the evidence that can be used support your claim?
- Why is it important for scientists to share their results from their experiments?
- What happens if a scientist or classmate makes a claim that is false or has very little evidence? What could be done to test their claim?

Assessment:

Student Journal:

The teacher will review student responses in their journals to assess the use of vocabulary and ideas of evidence and claims.

Day 7

Introduce Question: What type of salt is most effective at melting ice on the roads?

Introduction

- Review the results of the homework interview.
- Review the steps scientists use to conduct an experiment.
  - Ask a question
  - Make a guess (hypothesis)
  - Plan the experiment
  - Measure the results
  - Share the results – presentation, writing, conversation
  - Ask more questions
- Explain to the students that today, they will begin designing their experiments to see which salt melts ice more quickly.

Designing the Experiment:

- Discuss the question, "Which type of salt will melt water more effectively?"
- Introduce the materials that will be used: A, B, C (I have bought many kinds of salt: iodized, solar salt, water softener, magnesium chloride, feeding salts, sea salt).
- Have each group create their own hypothesis.
- Each group discusses materials, this time the students will write their own list.
- Each group discusses the method of the experiment – the step by step procedures.
  - Amount of salt, time in melting, how often the trays will be measured, and location of trays.
  - At this time, each group will have two different salts and then a plain ice as the control. Then we will compare data. The teacher will make sure a variety of salts are used.
  - Students will record these on their lab sheets.

Begin Experiments

Have students place trays in designated areas.

Measure melt-off throughout the day and record results in the table.

Assessment:

Student Journal:

Write a summary of your results. Which salt melted the ice more effectively? What evidence can you use to prove your claim?

Compare your results and your hypothesis. Was your hypothesis correct? Is it okay to have a hypothesis that does not match the results.

Day 8 - 9

Question: How can we analyze data and use it to make claims?

Sharing Results:

Student will work in their groups to create posters to share their data. Their poster should include:

1. Question
2. Hypothesis
3. Materials
4. Procedures
5. Data in a table
6. Graph
7. Summary of results (claims using evidence)
    a. Which salt melted the water more effectively?
    b. A very basic cost analysis
    c. Recommendations for further study
    d. Questions

Assessment:

Student Journal: What was the effect of salt on water? Which salt was more effective? Use evidence to back-up this claim.

.

Day 10
Present Data

Appendix G

Procedural Writing Template

How to make a ____

By ____

When it is finished, it should look like this:

On the next few pages, you will learn to make a _______________________.

You might want to make this because __________________________________

____

You will need:

____

____

____

____

____

____

____

____

	1. ____________________
	2. ____________________
	3. ____________________
	4. ____________________
	5. ____________________
	6. ____________________

APPENDIX H

Scientific Investigation Template

Name: ____

Questions:

____

____

Hypothesis:

____

____

Materials

1. ____
2. ____
3. ____
4. ____
5. ____

Procedures – Write each step you did to complete your experiment.

First
Second
Next
Then
Last

Results/Findings:

____

____

Questions or Suggestions if someone else were to do your experiment:

____

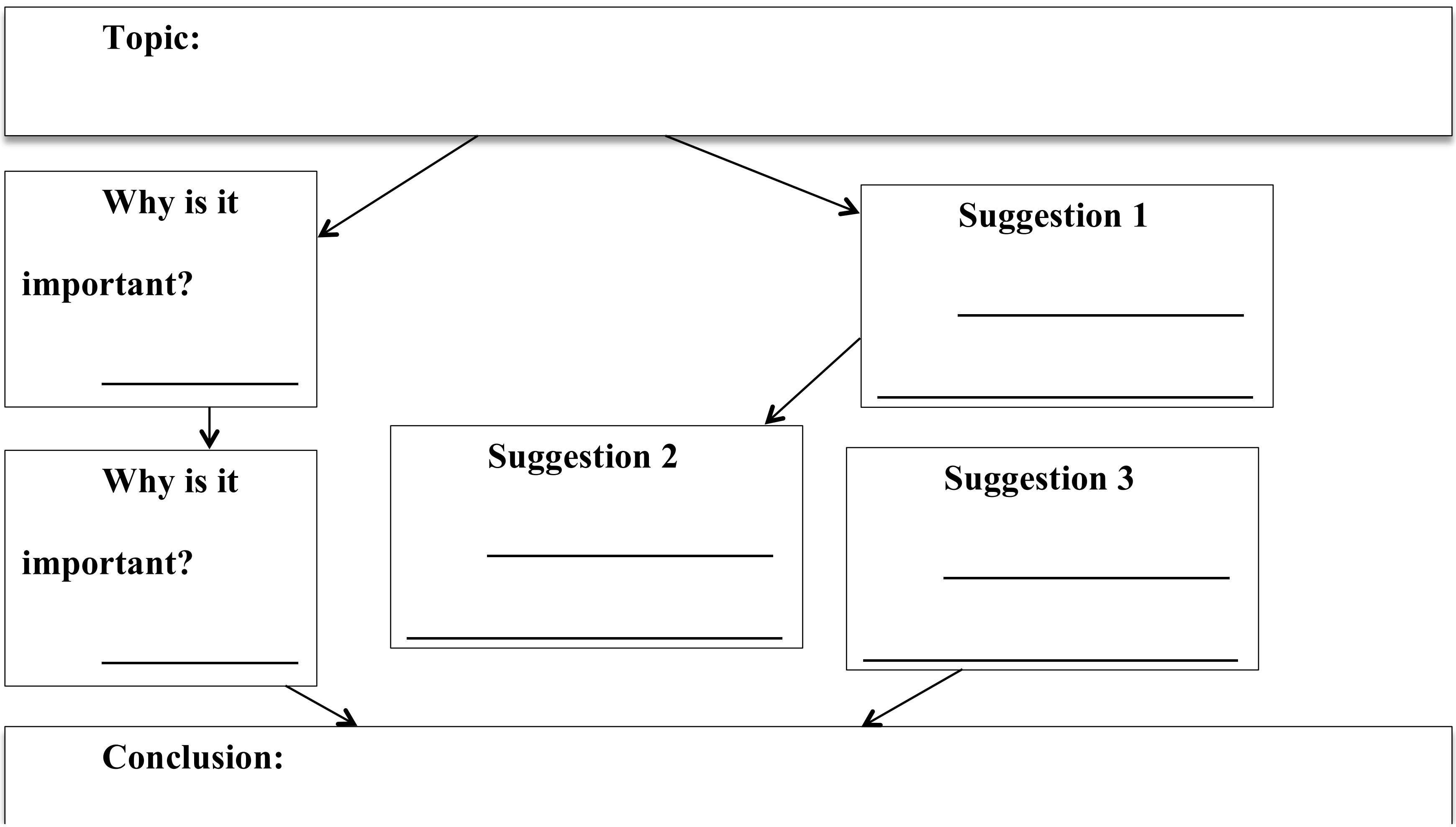
____

____

____

Appendix I

Claims and Evidence Template



Appendix J

Student Journal Pages

Day 1

Question: What is most effective at melting ice?

Experiment:

Today you will each receive a plastic container full of ice. I filled the containers and froze them last night. Your job today will be to measure the water melt off throughout the day. Your group will get to decide where to put your container (inside or outside). As a class we will choose how often we will go and measure the water.

Estimate how many milliliters (mL) are in your group's container.

Our group's estimate is that our container has _______ mL of water.

Where will your group put your container to melt the ice?

Our group will put the container ___________________________________ because

____

____

How often did our class decide to check the ice melt-off?

We decided to check the ice every ______________________________.

Data Table

Your job will be to fill out the table as you measure your ice melting. At the end your group should be able to tell how much water was put in the containers.

Time	mL of water

What was the total amount of water in you container? ______________________

Questions

1. How much water did your group have in its container?

2. Which groups' ice melted the fastest? What evidence can you use to prove your claim?

3. Would there be a better way to design the experiment? In other words, how could we change the experiment to know if the results were valid?

Reflection

1. Did our first experiment have equal results? How do you know?

2. Was it easy or difficult to compare all the groups' data? Why or why not?

3. If our class wanted to measure how fast water would freeze, what steps do we need to take to make sure the results are equal?

Day 3-4

Reflection

1. How did we insure that our experiment was fair?

2. What is your group's hypothesis? Why did you choose that material as the most effective?

Where will your plans be placed? ___________________________

How often are you checking the water melt off? ______________

	plain	**salt**	**sand**	**sugar**

Reflection

4. Write a summary of your results. Which material melted the ice more effectively? What evidence can you use to prove your claim?

Day 5

Reflection

1. What did our class data show as the most effective material to melt ice? What is the evidence that can be used support your claim?

2. Why is it important for scientists to share their results from their experiments?

3. What happens if a scientist or classmate makes a claim that is false or has very little evidence? What could be done to test their claim?

Day 6 – 7

In your groups you will be conducting an experiment using two different kinds of salt to melt water.

The two kinds of salt we chose:

1. ____

2. ____

Question: Which type of salt will melt water the quickest?

Hypothesis:

____

____

Now you will need to decide how much salt you will use?

How much water will you put in each pan?

Where will you place your pans?

How often are you checking the water melt off? ____________

	Salt 1	**Salt 2**	**Plain**

Reflection

5. Write a summary of your results. Which material melted the ice more effectively? What evidence can you use to prove your claim?

6. Compare your results and your hypothesis. Was your hypothesis correct? Is it okay to have a hypothesis that does not match the results? Why or why not?

Author's Biography

Jamie Litvinoff lives in a small rural town in Wyoming. She grew up in Cheyenne and graduated from East High School. Jamie received her undergraduate degree from the University of Nevada Las Vegas. After graduating, she subbed for one year in Cheyenne and then received a teaching job as a fourth grade teacher in Las Vegas. Jamie taught four years in Las Vegas and taught third through fifth grade. In 2005, she married Chris Litvinoff and in 2008 they moved to the rural town they now call home. Jamie taught second grade for six years before moving to fifth grade in 2014-2015 school year. In 2012, Jamie and Chris adopted their son and are currently waiting on the adoption list for another child. Jamie began the SMTC program in 2010, and has loved taking classes and meeting the wonderful people at the SMTC. She will be forever grateful to Dr. Ana Houseal for being her mentor the past five years.