5-2017

Integrating Literacy and Science in an Elementary School Classroom

Morgan J. Dye
East Tennessee State University

Integrating Literacy and Science in an Elementary School Classroom

Morgan Jade Evelyn Dye

Presented to

Dr. Huili Hong

College of Education Honors Program

And

The Faculty in the College of Education

East Tennessee State University

In Partial Fulfillment of the

Requirements for the Teacher Education Honors Program

May. 2017

5/2/2017

Lashay Jennings 5/2/2017

5/2/2017

Table of Contents

CHAPTER ONE- INTRODUCTION 3
Statement of the Problem 3
Purposes of the Study 5
Research Questions 5
Theoretical Assumption that Supports the Integration of Science and Literacy 6

CHAPTER TWO- LITERATURE REVIEW 7
History of Literacy & Science Integration 7
Prior Connections 7
Integration in Teaching Practice 8
Social Aspects of Integration 9
Integrating Academic Language 10
Significance and Limitations of this Study 10

CHAPTER THREE- METHODS 12
Research Hypothesis 12
Research Questions 13
Research Context/Participants 13
Chosen Data: A weather unit 14
Research Design 14
Data Corpus Table 16

CHAPTER FOUR- RESEARCH FINDINGS 17
Findings 17
Future Studies/Conclusion 19
APPENDIX A 20
APPENDIX B 21
References 22

CHAPTER ONE Introduction

Typically, children in elementary classrooms have trouble grasping the various concepts of the world around them. Although most early childhood educators agree that science is a valuable subject, there has been little direct instruction laid out to teach it in early grades. Compared to those of later grades (e.g. fourth or fifth grade), the lower level grades have very limited science instruction or integration, which tends to limit the students on their conceptual development. For this reason, the integration of science and literacy and how it affects children's conceptual knowledge is a valuable study for the future of the education system. This study will be significant in being able to provide valuable insight for how integration benefits students and their overall conceptual and procedural fluency. Since implications such as No Child Left Behind (2001) and Common Core State Standards (2009), some schools have completely illuminated science instruction from the early grade curriculum (Hoffman, Collins, & Schickedanz, 2015). For this reason, many teachers, particularly in grades K-2, have chosen to integrate it into their literacy block using a variety of techniques.

Statement of the Problem

By eliminating science instruction, school systems are decreasing the likelihood that the students will be able to construct understandings, communicate inquiries, negotiate, and justify throughout their grade school careers. In science instruction, students are taught to orally present their scientific results, negotiate hypothesis, and justify their reasoning (Washburn & Cavagnetto, 2013). By eliminating it, school systems are stripping students of their presentation skills, experimentation skills, and all scientific knowledge needed for their high school or college careers. Also, if teachers or administrators choose not to integrate science instruction, they are

greatly increasing the risk for student misconception once the student reaches higher level grades. By implementing some form of science instruction through integration of science with literacy, the risk for student misconception drastically decreases (Vitale & Romance, 2011). It is also extremely beneficial for students when science and literacy is integrated within the classroom because the science content knowledge provides an authentic and engaging context for literacy learning and vice versa (Pearson, 2006).

As students advance into higher grades that are intensive and richer in content knowledge, their misconceptions generally increase and they are much less likely to understand the content, particularly in science and inquiry (Washburn & Cavagnetto, 2013). For students to understand the material, they must be able to do more than read their textbook or recognize the academic language used throughout a unit of instruction. Teachers want their students to be able to comprehend, interpret, and engage in the scientific texts (Washburn & Cavagnetto, 2013). However, considering there is a lack of science integration, there is also a lack of student science comprehension. Science inquiry is an excellent motivational tool for students to learn to speak, write and read texts accurately (Hapgood & Palincsar, 2007). One solution to prepare students for state tests (e.g. TCAP) is to integrate the two disciplines of science and literacy by connecting real-world experiences with access to a variety of texts. By doing integration in science and literacy, students are more likely to master both disciplines (Lee & Spratley, 2010).

Purposes of the Study

The purpose of this study is to understand the influence that the integration of science and literacy can have on the first-grade student's conceptual knowledge in a city school who, typically, only see literacy and mathematics instruction throughout a typical school day. For example, after reading the scientific texts to students, how they can use the information learned to aid in their understanding of the science activities. Also, if students can better grasp the science concepts from the literacy lesson, the overall purpose will be achieved, learning. Literacy and science integration can aid students in content understanding. It involves keying in on the impact science has on our world and allows students to incorporate written, oral, or visual aids into their learning. By doing this, students gain the opportunity to read, write, and defend their thinking in an insightful manner. In turn, they gain an awareness of science concepts (Turnbull, 2017).

Research Questions

1. How do students respond to the weather activities after being exposed to scientific read alouds?
2. How will the impact of center-based science inquiry on students reading comprehension and conceptual understanding of science knowledge change when the teacher engages students in scientific inquiry through the use of centers?

Theoretical Assumption that Supports the Integration of Science and Literacy

The research study is to explore how integration of science and literacy may impact students' scientific conceptual understanding/learning in a first-grade classroom .By integrating science and literacy instruction together, it will help the students draw inferences on the world around them by incorporating text features and context clues (Conceptual Development, Slide 8). Science and literacy aid upon each other well because of the similarities between the content skills (Bowers, 2000). To integrate in a way to which students understand the content sufficiently, you should begin with a piece of text that is relevant to the science concept being discussed (Bowers, 2000). Alternatively, if you begin by introducing the science topic, you should use literature that *includes* the topic you plan to discuss (Bowers, 2000). Integrating science will be successful because it keys in to students of all backgrounds, heritages, and races. All students can be included and engaged in science and literacy integration by linking personal experiences to the concepts, despite where they live, how they live or what language they speak (Turnbull, 2017). This investigation will be conducted from the framework of *discovery learning* (Slavin, 2015, p. 193) which can be related to hands-on inquiry. In this perspective, the students will be read aloud a scientific text and will be encouraged to complete a scientific experiment largely on their own by going to each work station (center). By doing this, the students will become actively involved in the scientific inquiry process and will work together in various social contexts (Slavin, 2015, p. 193) (Washburn & Cavagnetto, 2013).

CHAPTER TWO- LITERATURE REVIEW

History of Literacy and Science Integration

In the past, the curriculum has developed, evaluated, and revised in ways that maximize the concurrence between science and literacy, *traditionally* separate content areas. Also in previous years, teachers have been *encouraged* to integrate science and literacy instruction. For example, Carin and Sund (1985) encouraged teachers to integrate science with literacy instruction for the sake of efficiency. Despite the opinions of concurrence and overlap, Carin and Sund (1985) ended up taking a relatively *conservative* view of literacy and science integration. They stated that by doing read-alouds teachers were giving students opportunities to "listen to how science *sounds*" (p. 246) and to expand students' academic language in science (Cervetti, Pearson, Barber, Hiebert, & Bravo, 2006). However, science instruction seems to be one of the most common areas in which teachers feel uncomfortable in their own teaching. In the past, science instruction was often just the teacher demonstrating a science experiment to children in fear of challenging themselves or their students (Hindi, 2003).

Prior Connections

Baker (1991) attempted to connect reading and science through metacognition. By doing this, it was implied that science and literacy share a concern with harboring independent learning. Baker suggested that, while metacognition ("the awareness and control individuals have over their cognitive processes") is largely recognized as an essential component of literacy instruction, the connection to science has not yet been studied, although many science process skills can be regarded as metacognitive skills (e.g., formulating conclusions, critical analysis, evaluating their ideas, the main concepts, establishing relationships, etc.). Baker argued the focus

in science can help teachers establish independence through a variety of activities including "lectures, discussion, laboratory work, and inquiry" (p. 2).

Integration in Teaching Practice

When considering adding integration into your classroom routine, there are several different aspects that can be considered. For example, (Romance & Vitale, 1992-2001) created the IDEAS model of science and literacy integration. Rather than set aside a typical literacy block, the IDEAS model allocates time for science instruction that is included along with general reading and literacy skills. Romance and Vitale (1992, 2001) developed IDEAS of integrating science and literacy instruction. IDEAS took the place of traditional literacy instruction with a 2-hour time slot of science instruction that allowed attention to reading and language arts skills. The teachers who decide to use the IDEAS form of integration in their classrooms tend to choose hands-on, inquiry based activities. These activities will keep the students engaged in reading and ensure that the students get the benefits from both the science and literacy concepts (Romance & Vitale, 1992). Another strategy that can and should be implicated for integration is called Concept Oriented Reading Instruction, or CORI, which is what the readers need. CORI is often based around a science goal but provides direct instruction in reading and literacy strategies. One of the important characteristics of CORI is integration of the contexts and materials in ways that enrich the material. By doing this, students can make text-to-world connections within their reading (Guthrie, Anderson, Alao, & Rinehart, 1999). By allowing the students to make text-to-world connections with scientific texts, it allows the material to become more meaningful to them, which encourages reading and inquiry.

Science and literacy instruction can both be implemented through the means of inquiry based instruction. During science instruction, students conduct experiments as a form of inquiry. In reading and literacy instruction, the students infer and question, which are quite like conducting a scientific hypothesis and are a part of "inquiry" in the scientific discipline. When conducting a literacy lesson, text can also be used in ways that support inquiry by providing access to scientific information that students may otherwise would not have had access to (e.g. a text book) (Cervetti, Pearson, Barber, Hiebert, & Bravo, 2006). To incorporate both aspects into a unit plan, I plan to use a text based around my subject that is scientific based and requires students to investigate, question, and infer regarding their experiment. This will set the basis for the experiment that they will be conducting in their work center and prepare them for the day's activities.

Social Aspects of Integration

In addition to being discipline focused, science is a social context where the academic language that students use is "a powerful and specialized way of talking about the world, writing about the world, and even "being" in the world of scientists" (Lemke, 1990). When integrating science and literacy, the teacher must consider the social aspects of the two content areas. Science requires students to confer, so the teacher must provide students with ample opportunities for the students to discuss their findings using discourse and the language of science (Cervetti et al., 2006). By allowing students to discuss their inquiry findings, their findings through investigation via text, the teacher is encouraging cooperative learning and collaboration among students.

Integrating Academic Language

When integrating science and literacy, the teacher needs to take into account how to accurately incorporate academic language, vocabulary, and symbols into the lesson or text that he/she is using. Scientific texts offer multiple opportunities for the teacher to expand student academic language and vocabulary, an important aspect of the relationship between vocabulary knowledge and reading achievement (Hapgood & Palincsar, 2007). If the teacher has intentions on teaching a word (e.g. photosynthesis) then the students should be using that vocabulary in all contexts. The students should be reading a text regarding photosynthesis, working with plants, writing about their observations, etc. By allowing the students to work with the academic language, the teacher is allowing them to display their knowledge of the content and discipline for each day. Much of the academic language that students learn is a factor in their high stakes testing. Because of this, teachers should be very cautious of the activities and discourse chosen for academic language practice (Cervetti et al., 2006).

Significance and Limitation of this Study

Integration is a key part of success in elementary grades, particularly lower level grades. When school systems remove a content rich subject from the curriculum, the students are the ones who pay the price. By integrating science into the literacy block, the students will learn a wide range of skills that they will carry throughout their educational career. For example, the students will learn how to read and comprehend scientific texts and articles, how to investigate using inquiry based activities, and how to conduct experiments using hands-on tools. Through the integration process, the students will also dive into aspects of science that may otherwise be unfamiliar to them until middle or high school grades (e.g. academic language, discussions,

experiments, etc.). For this study, I will be working with students in science and literacy by completing a read-aloud and conducting a scientific experiment using work centers. By doing this, I will be able to see how the aspect of integration affects how the students understand the content that is being delivered to them, if they can retain the information better based on the inquiry, and if the aspect of literacy gives them an incentive to achieve their desired goal. On completion of this study, the results will greatly contribute to the study of literacy and science instruction and how integrating them into one block of time can lead to improvement in student learning.

CHAPTER THREE- METHODS

When beginning this study, I was interested in determining the effects of integrating science into what is typically a literacy based classroom. Based on the information from CORI, I predicted that by integrating the instruction this way, the students would have a greater conceptual knowledge of the subject (Weather), would have greater text comprehension, and scientific misconceptions would decrease (Rinehart, 1999). To do this, a variety of texts related to the topic (weather) were introduced over three consecutive days of instruction. Prior to beginning the center activities to aid in my research question, "How will the impact of information change when the teacher engages students in scientific inquiry through the use of centers?" the students were introduced to each text, exposed to academic language of each unit (wind, rain, etc.) and any apparent misconceptions were addressed.

Research Hypothesis

The alternative hypothesis posed in this study is that the integration of science and literacy will allow the students to better understand the concepts and gain appropriate conceptual fluency of science content. In turn, allowing them to complete each center activity related to weather and their weather texts accurately. For example, the students read about wind, air pressure, and temperature over the three-day course and then students complete activities related to these aspects of weather.

Research Questions

There are two research questions that I studied to confirm or reject my hypothesis. The first, how do students respond to the activities after being exposed to scientific read alouds? And the second, how will the impact of information change when the teacher engages students in scientific inquiry through the use of centers? By completing this study and providing answers to the previous research questions, I will be able to determine the depth to which integration aids students' conceptual understanding of science (in this case, weather) content.

Research context and Participants

Nineteen students from a first-grade class at Green Grass Elementary (10 boys and 11 girls) ranging in age from 6 to 7 years old, completed this study voluntarily. The students were not chosen at random, but were a class that I have been with since August, 2016. The students came from a variety of backgrounds, ethnicities, and socioeconomic statuses and representatives of the general population in East Tennessee. At the time of this study, there were ten boys and nine girls in the class. There were some restrictions when conducting this study. For example, one student has several IEP considerations, this resulted in difficulty of him completing the independent center assignments. For this study, the students conducted a whole-group literacy reading daily, and then on Day three were separated into random groups of 5, 7, and 7 to complete the center activities. When conducting this study, I chose to drift throughout the room and randomly assess groups to increase the accuracy of the results. I also chose to ensure the students were unaware of the study to help illuminate the risk of biased results. Typically, if the students know that they are being observed, they will act and respond differently than if they

believe that they are just participating in the lesson activities. The data and collections from this study of participants can be found in the following sections.

CHOSEN DATA: A weather unit

To begin this study, the students began their weather unit on February 1st. To aid in their learning, the teacher chose to integrate a variety of weather related texts for two days to coincide with her weather centers on Day 3. For the experiments, the students recorded temperature of water (ice water, warm water, and room temperature water), they observed and recorded the air pressure in the classroom using a barometer, and they observed how wind affects an anemometer. Prior to the weather experiments, the students read a variety of science texts over the three-day period before beginning their activities to determine the effect of integration. Some of the texts include: *Snug in the Snow* scholastic article, *Weather* by Catriona Clark, and *Weather Forecasting* by Gail Gibbons. Other specific materials that were used during this study include a kite, ice cubes, paper, weather packet, thermometers, IPad, water (cold and warm), markers, rain gauge, a fan, a barometer, and an anemometer.

Research Design

Students in this study were instructed to use the academic language and facts related to weather they had gained from the above texts to help them complete the wind, temperature, and air pressure activities on Day 3. The students were relatively unaware of the integration study and could complete the activities independently to decrease the possibility of inaccurate results. All students were read all the literacy texts on Days 1, 2, and 3. They began practicing their knowledge from the texts on February 3rd while completing their activities in each Center. For example, the students used thermometers to record their body temperature and compare it to the

temperature of an ice-cube. During this experiment, the misconception that arose was that students could place their finger on the thermometer and it would immediately record their temperature. The teacher modeled how to correctly hold the thermometer and used a clock to count to 60 for each student. On Day 3, the students began to practice all newly acquired skills by first holding the home-made kite and running to the West. As each student ran, the teacher and other students inquired about the direction of the kite and wind speed. Next, the students were placed in random groups to complete each of the three centers. Center one included a list of weather facts and opinions that the students had read about in the literacy texts. The students were to cut out the fact and opinion strips and glue them in the corresponding column (e.g. Fact or Opinion, sample in Appendix A). At center 2, the students practiced measuring temperature with thermometers. To do this, the students had 6 pre-filled cups that included warm water, cold water, and ice water (2 of each). The students left the thermometers in each cup for one minute and then recorded their findings on their paper. Center 3 included a home-made rain gauge in which students could fill up in the sink. As they took turns, the students recorded the amount of "rain" during each interval and compared it to that of the next student. Next, the students moved to the home-made barometer portion of Center 3 and recorded the pressure of the air. The students referred to it throughout their time at Center 3 to observe any changes. Lastly, the students used a fan to imitate wind and determined the change in speed using a home-made anemometer. By incorporating literacy sequentially over the three-day period, students could better observe, infer, and predict the outcomes of their experiments in each of the three centers (Padilla, Muth, & Padilla, 1991).

Data Corpus Table

Student Activities	Teacher Activities	Researcher Activities
DAY 1: At their desks, the students read along to the literacy read-aloud *Weather* by Catriona Clark and completed pages 1-2 of their science weather packet independently.	The teacher read several pages from the read-aloud *Weather*, and went over academic language and vocabulary with students.	The researcher drifted as students completed their weather packet and answered questions (if needed).
DAY 2: The students read-along to the literacy read-aloud *Weather* and *Weather Forecasting* by Gail Gibbons. The students completed pages 3-4 of their science weather packet independently.	The teacher completed the read-aloud, Weather, and went over weather instruments with students, providing them the skills needed for the following day.	The researcher drifted as students completed their weather packet and answered questions (if needed). The researcher also prompted students by asking questions regarding the weather instruments and academic vocabulary from the previous session.
DAY 3: The students participated in the kite activity to determine wind flow and worked in each center independently. The center activities included: Taking temperature, working with a rain gauge, a barometer, and answering questions regarding weather facts.	The teacher drifted and worked with students in each center and tried to clear any misconceptions as they arose. The teacher also demonstrated the use of the barometer by mimicking wind using a fan, and demonstrated the use of the rain gauge using the classroom sink.	The researcher drifted throughout each center and took pictures of student work. The researcher also asked students questions regarding their answers (e.g. Why is this a fact?) to which the children generally referred to the literacy texts.

CHAPTER FOUR- RESEARCH FINDINGS

Findings

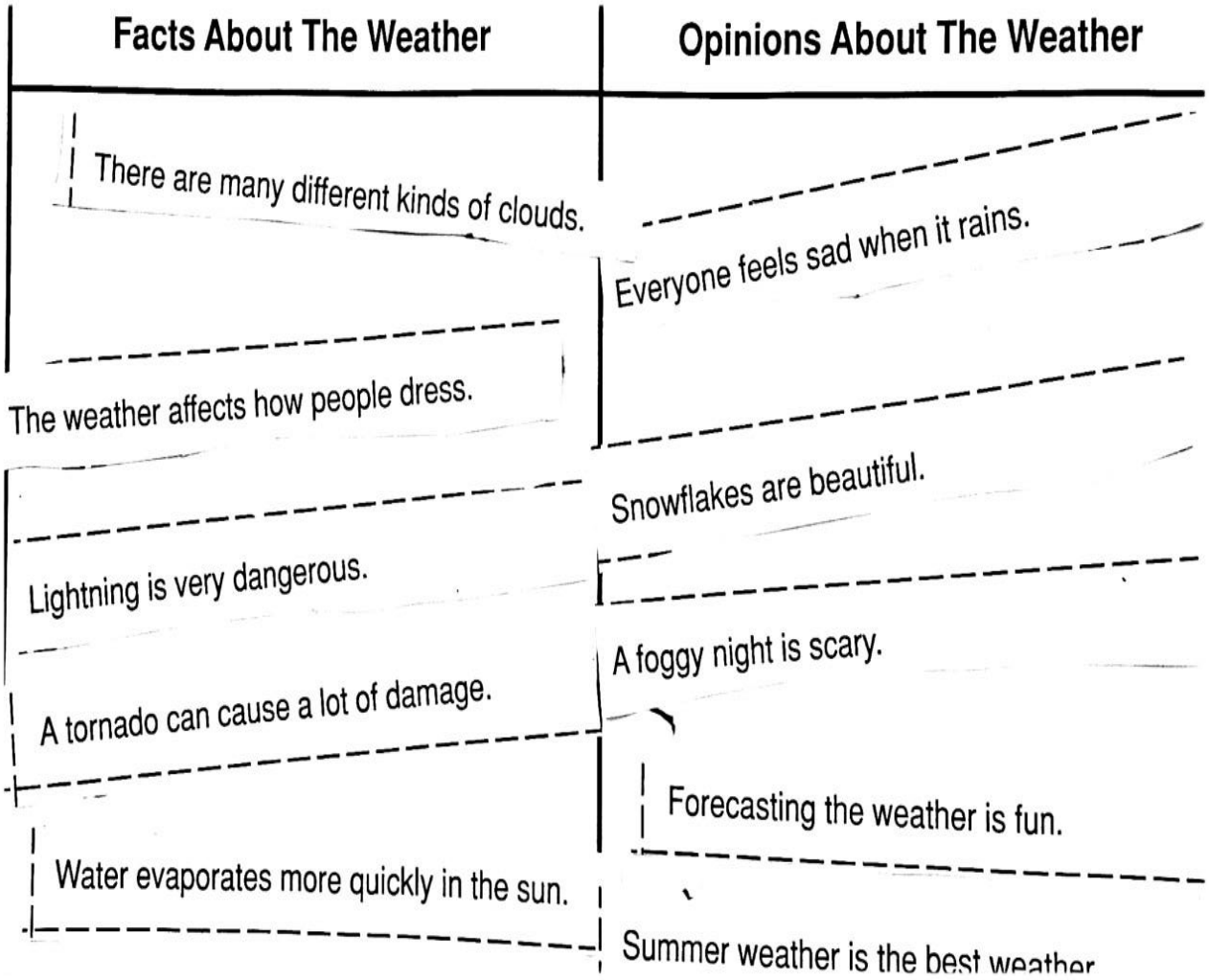
My hypothesis for this study was that, by integrating science and literacy, the students would be able to better understand the concepts and gain appropriate conceptual fluency, allowing them to complete each center activity accurately. To do this, the students heard scientific texts throughout three sequential days and then completed three centers that related to deeper learning. Through the study, I found on Day 1 that the students were very interested in their literacy text, particularly when the teacher referred to the academic language and vocabulary portions. I also found that the students had several misconceptions prior to the read aloud that several of them were quick to reiterate or change their opinion. On Day 2, the students were intrigued and read to finish their *Weather* text and could answer some simple vocabulary term questions (e.g. What is a barometer?) However, some misconceptions still existed. For example, the teacher allowed the students to practice using a thermometer in anticipation for the following day's activities. Rather than give the thermometer time to read their body temperature, the students would press it to their skin, remove it, and state that their temperature was significantly lower than normal (e.g. 56°) When shown the proper technique for recording body temperature (hold it for 60+ seconds) the students could get a more accurate read. On Day 3, the students participated in a kite activity. Using a fan, they mimicked wind and practiced determining the direction of wind flow. Many students were unable to do this. I feel as if they struggled with this because the texts that were used did not put an emphasis, or mention in detail the direction of wind flow and how it affects items in the air. The students also participated in their centers on this day. The students were much more successful taking and recording their

temperature and although there were some who struggled, I feel as if they achieved the overall concept. During this time, several students referred to the *Weather* text and incorporated academic language that they learned to compare their temperature with that of the water (e.g. Degrees, Fahrenheit, Celsius). When completing the worksheet about weather facts, almost all the students used the literacy texts to check their answers. Based on my observations, I feel that the students could recall most of the text information and wanted to ensure that their answers were correct. Many of the higher-level students did not need to refer to the texts used during this three-day unit. When prompted, one student responded with "Well, we learned it in *Weather*." I found that students had a better understanding of the academic language (thermometers, anemometers, etc.) and could use the language and tools to complete center activities because of this integration process. By incorporating the literacy texts, the students could gain somewhat of a procedural fluency. For example, the students had little-to no questions regarding the materials or how to use them, which is common within this class. Students also used the information they learned from the literacy texts to complete the "Fact or Opinion" sheet set for Center one. (Appendix A). The students were also better able to read and record the temperatures of the water for center two. (See appendix B). In their final centers, the students referred to each literacy text for examples of rain gauges and barometers and how to use them. Overall, through this analysis it is my opinion that by integrating science with literacy, the students were better able to grasp the concept of the given topic (weather) and it was much easier for students to recall information from the previous day. By intertwining these two subjects, students could continuously have a guideline within the texts, thus allowing them to reach procedural fluency.

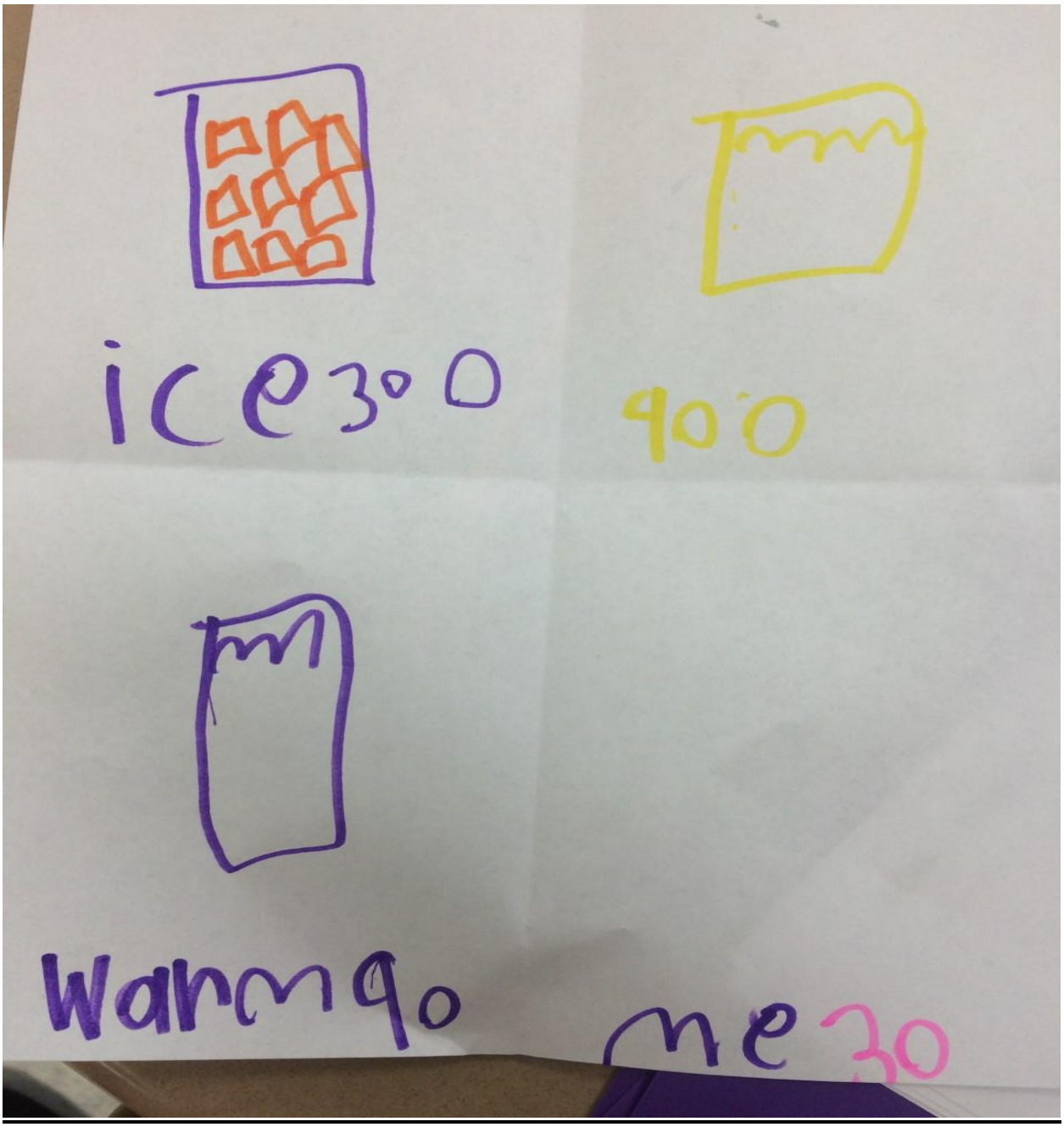
Future Studies/Conclusion

For future studies related to science and literacy integration, I would like to build on my findings from this study. For example, I am interested in determining the outcome of integration throughout the student's grade school career. I would like to incorporate the WEE (Wondering, Exploring, Explain) strategy in grades 3-9 to allow students to use texts to pose their own scientific questions, explore concepts, and justify their reasoning through literacy integration. This program motivates students to answer questions themselves rather than focusing on the text as the ultimate potency in science (Anderson, West, Beck, Macdonell, and Frisbie, 1997). In conclusion to my hypothesis, it is my professional opinion that the effect of integrating science and literacy into the weather unit, positively affected the students in their learning. After conducting daily read alouds, the students could better comprehend the material being presented to them and could complete the activities (kite, temperature recording, etc.) without fault. Some core findings *prior to* the read alouds were unveiled. However, after completing the read alouds and seeing teacher models, the students had a better understanding of the feature in which they were studying and the teacher could correct the misconception prior to the center activities. Upon completing each center on Day three, the students incorporated the academic language, completed each activity without avail, and could justify their answers as needed. Although my student with Autism was absent throughout the course of this study, my English Language Learner could complete all activities, incorporate academic language, and discuss findings with peers. My student with an IEP did struggle working independently, but *could* complete the center activities with teacher prompting/scribing. Overall, my hypothesis that integrating science and literacy would have a positive effect on student learning was confirmed because of this study.

APPENDIX A


Facts About The Weather
Opinions About The Weather
There are many different kinds of clouds.
Everyone feels sad when it rains.
The weather affects how people dress.
Snowflakes are beautiful.
Lightning is very dangerous.
A foggy night is scary.
A tornado can cause a lot of damage.
Forecasting the weather is fun.
Water evaporates more quickly in the sun.
Summer weather is the best weather

APPENDIX B



References

Anderson, T.H., West, C.K., Beck, D.P. Macdonell, E.S., & Frisbie, D.S. (1997). Integrating reading and science education: On developing and evaluating WEE Science. Journal of Curriculum Studies, 29(6), 711–733.

Baker, L. (1991). Metacognition, reading, and science education. In C. M. Santa & D. E. Alvermann (Eds.), *Science learning: Processes and applications* (pp. 2– 13). Newark, DE: International Reading Association.

Bowers, P. (2000). Reading and Writing in the Science Classroom. Retrieved from http://www.eduplace.com/science/profdev/articles/bowers.html

Bruner, J. S., Olver, R. R., & Greenfield, P. M. (1966). *Studies in cognitive growth*. New York: Wiley.

Carin, A. A., & Sund, R. B. (1985). Teaching modern science (4th ed.). Columbus, OH: Merrill.

Cervetti, G. N., Pearson, P. D., Bravo, M. A., & Barber, J. (2006). Reading and writing in the service of inquiry-based science. In R. Douglas, M. Klentschy, & K. Worth (Eds.), *Linking science and literacy in the K–8 classroom*. Arlington, VA: National Science Teachers Association.

Conceptual Development [PDF]. (n.d.). Web. Retrieved from http://www.psychology.sunysb.edu/hwaters-/psy325/slidesets/325slideset8a.pdf

Guthrie, J. T., Anderson, E., Alao, S., & Rinehart, J. (1999). Influences of concept-oriented reading instruction on strategy use and conceptual learning from text. *The Elementary School Journal*, *99*(4), 343–366.

Hapgood, S., & Pallincsar, A.S. (2007). Where Literacy and Science Intersect. Education Leadership, 64 (4), 56-60.

Hindi, A. (2003). Integrating literacy and science in the classroom: From ecomysteries to readers theatre. *The Reading Teacher,* 56*(6),* 536-538.

Hoffman, J., Collins, M., & Schickedanz, J. (2015). Instructional challenges in developing young children's science concepts. *The Reading Teacher*, *68*(5), 363-372.

Lee, C.D., & Spratley, A. (2010), Reading in the Disciplines: The Challenges of Adolescent Literacy. Carnegie Corporation of New York, 17-18.

Padilla, M. J., Muth, K. D., & Lund Padilla, R. K. (1991). Science and reading: Many process skills in common? In C. M. Santa & D. E. Alvermann (Eds.), Science learning—Processes and applications (pp. 14–19). Newark, DE: International Reading Association

Pearson, D. (2006, July 14). Science and Literacy—A Natural Integration. Retrieved April 04, 2017, from http://www.nsta.org/publications/news/story.aspx?id=52301

Romance, N. R. & Vitale, M. R. (1992). A curriculum strategy that expands time for in-depth elementary science instruction by using science-based reading strategies: Effects of a year-long study in grade four. *Journal of Research in Science Teaching*, *29(*6), 545-554.

Romance, N. R. & Vitale, M. R. (2001). Implementing an in-depth expanded science model in elementary schools: Multi-year findings, research issues, and policy implications. *International Journal of Science Education, 23*(4), 373-404.

Slavin, R. E. (2015). *Educational Psychology: Theory and practice* (11th ed.). New Jersey: Pearson.

Turnbull, M. (2017). Why is Science Literacy So Important? Retrieved from http://www.letstalkscience.ca/about-us/why-science.html

Vitale, M., & Romance, N. (2011). Using in-depth science instruction to accelerate student achievement in science and reading in grades 1-2. *International Journal of Science and Mathematics Education, 10*, 457-472.

Washburn, E. & Cavagnetto, A. (2013). Using argument as a tool for integrating science and literacy. *The Reading Teacher, 67*(2), 127-136.