

USING PICTUREBOOKS TO ENHANCE THIRD GRADE SCIENCE
INSTRUCTION AND MEET THE ENGLISH LANGUAGE ARTS
COMMON CORE STATE STANDARDS

by

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ABSTRACT

Teachers are constantly being asked to use innovative ways to teach core subjects, especially science. Teachers need to get students engaged and actively learning, at all times and that is not an easy task.

The purpose of this project was to explore the use of quality children's literature in enhancing science instruction in the third grade curriculum while implementing and helping students meet the English Language Arts Common Core State Standards (ELA CCSS). I researched how using children's literature in the science curriculum may be beneficial for students. I have created a handbook that third grade teachers can use as a resource to enhance their science curricula. This handbook breaks down the four bodies of knowledge (Life Science, Earth and Space Science, Physical Science, and Nature of Science) and eleven big ideas for the third grade NGSSS. It includes titles and short descriptions of picturebooks that relate to those benchmarks. It also relates the third grade science benchmarks to the ELA CCSS through activities teachers can use to teach any given benchmark.

DEDICATION

To my family and friends, I could not have done this without your constant support and encouragement. I know you will support me through all my academic endeavors and will always be there to guide me in the right direction. Thank you and I love you!

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TABLE OF CONTENTS

CHAPTER ONE: INTRODUCTION.....	1
Personal Rationale:.....	1
Broader Rationale:	2
DEFINITION OF TERMS	4
CHAPTER TWO: REVIEW OF LITERATURE	5
CHAPTER THREE: METHODOLOGY	10
CHAPTER FOUR: RESEARCH RESULTS	12
CHAPTER FIVE: CONCLUSION	16
Further Research Ideas	17
APPENDIX A: HANDBOOK CONTENTS FOR: Nature of Science	19
APPENDIX B: HANDBOOK CONTENTS FOR: Earth and Space Science	24
APPENDIX C: HANDBOOK CONTENTS FOR: Physical Science	28
APPENDIX D: HANDBOOK CONTENTS FOR: Life Science	35
REFERENCES.....	41
PICTUREBOOKS CITED.....	44

CHAPTER ONE: INTRODUCTION

Personal Rationale:

Motivating students in the classroom is a constant struggle that teachers have to deal with on a daily basis. Currently, as a teacher candidate, I want to do my best to ensure that I will be able to effectively teach my future students as well as get them excited about school. Science is a subject I always struggled with in school, specifically elementary school. I was never intrigued by the topics and subject matter I was being taught, nor did I feel the information would be useful in day-to-day life.

After taking a children's literature class during my teacher preparation coursework, I realized picturebooks could be used in a variety of ways. Specifically, I found it interesting how teachers can adapt the content of a picturebook to teach many different subjects. Students are far more likely to gravitate towards a picture book to learn content as opposed to a textbook. According to Atkinson, Matusevich, and Huber (2009) readability is a big factor in students leaning towards picture books. Textbooks are often written above grade level for the intended audience and when students have the opportunity to learn the same content from a picture book, they choose the latter.

My goal is to make science interesting for students; I want to be able to keep them engaged in science-related activities. I would like for students to have a different experience with science than I did. Science is all around us and I want students to see and understand how it all works and using picturebooks to do so may be a great approach.

Broader Rationale:

With science often a subject teachers find difficult to teach, educators need resources that help engage students and improve their overall comprehension of the subject matter. Teachers tend to believe students do not find informational text interesting or that it may be too difficult. These beliefs combined with teachers' low understanding of science concepts lead to them covering topics very briefly, in turn sending the message that science is a boring subject (Mantzicopoulos & Patrick, 2011). Research has shown that students' views and attitudes toward different types of texts are greatly influenced by ways their teachers use, present, and discuss different genres in the classroom (Leung, 2008).

Using informational picturebooks to enhance learning is a path all teachers should take, especially when teaching science. Mantzicopoulos and Patrick (2011) found that young students respond well to informational text that is presented side-by-side with fictional text. Students are then able to compare and contrast similarities and differences in both texts. Discrepancies about facts between the two texts may confuse students, so it is important for the teacher to clarify any lingering questions students may have about the content at hand. This is particularly important for ESOL students because they are more likely to misinterpret information. ESOL students benefit from picturebooks because they provide information in a clear-cut manner that kids understand. Using picturebooks in the classroom is beneficial to all students because they gravitate towards them and they provide a means to learn in a new and exciting way.

In the state of Florida, teachers are now required to follow the Common Core State Standards (CCSS) in English Language Arts. Building knowledge through content rich nonfiction is an essential role in literacy in and in the Standards. The CCSS also require teachers to provide students with complex texts for them to analyze and discuss. The CCSS are rigorous, research based, and internationally benchmarked. These standards are not only for English Language Arts, but also for literacy in content areas such as history, social studies, and science. This means teachers are expected to use the English Language Arts standards in their instruction for all subjects. They can no longer, for example, focus only on science during science; they need to incorporate the English Language Arts standards into their teaching as well. This goes for all subject areas, using cross-curricular connections when teaching any subject is very important given the rigorous expectations of students and teachers. (National Governors Association Center for Best Practices & Council of Chief State School Officers, 2012). My hope is that my project through the use of my created handbook will help teachers. The handbook I developed relates the Next Generation Sunshine State Standards to the Common Core State Standards for English Language Arts by listing activities and books that match the standards. Teachers will be able to use this information to guide science instruction and make cross-curricular connections.

This thesis explored the use of quality children's literature in enhancing science instruction in the third grade curriculum while implementing and helping students meet the English Language Arts Common Core State Standards (ELA CCSS). I researched children's literature and found quality texts that are appropriate to present third grade

science concepts and have compiled a handbook that correlates the texts found to the science standards and offers ways to integrate the ELA CCSS. My hope is that this handbook will make it easier for teachers to find and use appropriate and effective informational picturebooks to teach science and help students meet the rigorous demands of the ELA CCSS in their respective classrooms.

In an effort to assist the reader, a list of definitions of terms is provided below.

DEFINITION OF TERMS

- **Picturebook**- inextricable connection of words and pictures and the unique qualities of the form (Wolfenbarger & Sipe, 2007).
- **Fiction**- literature with information or events that are not real.
- **Nonfiction**- literature with information or events that are real.
- **Faction**- literature with information or events that are a mix of fiction and nonfiction.

CHAPTER TWO: REVIEW OF LITERATURE

Children's literature has the ability to create meaningful context that can make learning relevant to students. Fiction and nonfiction picturebooks can contain process skills in a context that speaks to children. This enables students to make connections to the real world and their daily lives. Process skills are skills that mirror behavior of scientists and are abilities that transfer to other situations. These skills are important in learning about the world around us (Monhardt & Monhardt, 2006).

Using picturebooks to enhance learning in science is well documented. According to Gwekwerere and Buley (2011), students tend to gravitate towards picturebooks as opposed to textbooks for various reasons. One being, the student may be limited in literacy and comprehension strategies, when reading a textbook that is above their level. So, picturebooks provide an outlet where the student can learn content through a book that is intended for children to read. Another being, vocabulary that is presented in textbooks is often too difficult for the student reading it (Gwekwerere & Buley, 2011). Again, picturebooks typically use basic vocabulary, although when using difficult vocabulary, there are plenty of context clues, such as words and illustrations, given in the text that help the reader understand the content. Using an informational picture book to teach the same concept may help a student comprehend abstract ideas they otherwise may not understand if strictly reading information from a textbook.

English Language Learners (ELLs) also benefit from the use of children's literature in the classroom. Collins (2010) suggests ELL student's benefit from the vocabulary used in children's literature because it supports their vocabulary acquisition. Carrying over the use of new vocabulary words into curricular activities helps build students' target word learning and general vocabulary development (Collins, 2010).

Gwekwerere and Buley (2011) also suggest picturebooks present information in a way that is relevant and more interesting in the science curriculum. Quality literature has the possibility to introduce science concepts, support science process skills, develop background knowledge and enhance literacy process skills (Gwekwerere & Buley, 2011).

The use of children's literature in science education is important because it helps build background knowledge or extend knowledge on scientific concepts. Learning science concepts through a textbook is daunting for many students; children's literature, particularly picturebooks can pave a path for students to explore scientific knowledge without becoming overwhelmed. Children's literature can help create meaningful context in which students see science as part of their daily lives (Bintz, Sheffer, & Wright, 2010). Children's literature can be a great alternative to textbooks because it often peaks students' interest and turns students into active learners (Shelley, 2007). These books provide up to date information and appeal to students for a variety of reasons, some of which include, a mixture of quality writing, magnificent photography, and engaging graphics (Ford, 2006).

The Teachers' Choice Project is a collaboration between the International Reading Association (IRA) and the Children's Book Council (CBC), in an effort to glean the top pieces of quality literature that have potential to be used in content area instruction. Over three hundred books are sent, each year to various teams of teachers, librarians, and reading specialists in seven regions across the United States. These teams use the books with students and provide feedback. The results from all seven regions are analyzed and a list comprising of approximately thirty books is distributed, showcasing the best books teachers can use in their classrooms to guide instruction in content areas (Broemmel & Rearden, 2006). Knowing there are books already selected by reputable sources is a great resource to have on hand when compiling a list of my own for my handbook. Being able to look back and see which trade books have been recognized for their academic content will be a wonderful place to start.

Broemmel and Rearden (2006) suggest that when teachers use high quality picturebooks in their classroom to guide instruction, the results are blatantly obvious in student records. Broemmel and Rearden also found that students in a classroom that used a literature-based program integrated with literacy and science instruction scored higher on all literacy measures and on two out of three science measures as opposed to a literature-only group or control group. These students were also self-motivated and enthusiastic about science. Approximately 80% of students who were in the integrated program claimed they enjoyed science as opposed to approximately 40% in the other two groups. According to Smolkin, McTigue, Donovan, and Coleman (2009), 64% of kindergarten through fourth grade classroom teachers stated they used a science

textbook to guide instruction. Although that is a lower percentage compared to the 85 % of teachers in grades five through eight that stated they relied solely on textbooks for science instruction, teachers in the primary grades could further enhance their science instruction by using appropriately chosen picture books.

Use of quality children's literature should be ongoing and consistent. If used correctly, children's literature has the potential to enhance and enrich the science curriculum (Ediger, 2010). Knowing that students benefit from the use of informational picture books, researchers created a program called "ScienceStart!" (Leung, 2008). It is a program for preschoolers in which they are exposed through read alouds to narrative and informational picturebooks that present age-appropriate science concepts. The program uses a hands-on approach to science activities and teaches students about the scientific method and problem solving. This curriculum was implemented over a seven-month period with pretest and posttest scores showed significant gains.

The "ScienceStart!" curriculum was designed with the goal of creating a knowledge base about the everyday world, for preschoolers. It was also geared towards students learning the developmental skills needed to convey information, how to participate as a member of a group, as well as attention management and problem solving. The creators of this program chose to develop a science program because they felt science is engaging for children which makes it an ideal content area for supporting students' learning and development (French, 2004).

When teaching science, it is best for teachers to intertwine a literacy-based curriculum with hands-on activities in order for students to fully grasp the content. Relying on one method alone may not prove as effective as when both are utilized. When selecting trade books for classroom instruction, it is imperative the teacher chooses books that contain accurate information. This is especially the case when choosing text for science instruction. At times, textbooks contain information that is false which leads to confusion among students. In order for teachers to teach science content, through children's literature, with valid information they need to thoroughly review the book before presenting it to their class (Olness, 2007). Picture books, when scientifically accurate, have the ability to present information to students through stories and illustrations not accessible through direct observation (Pringle & Lamme, 2005).

More commonly, teachers do not have the time nor feel comfortable with science content enough to analyze a children's literature text before using it in their curriculum. In so doing, the teacher is doing a disservice to his or her students, because the students may gain misconceptions or incorrect information about a specific science concept (Schussler, 2008). With the amount of children's literature released each year, it is important for teachers to carefully pick and choose which books they want to bring into their classroom. It is also recommended that teachers have a checklist to go by when selecting books to use for classroom instruction. The National Science Teachers Association website is a great source that has a list of criteria to follow, when choosing books for a classroom (Atkinson, Huber, & Matusevich, 2009).

CHAPTER THREE: METHODOLOGY

This thesis explores the use of fiction and nonfiction children's literature texts in enhancing science instruction within the third grade curriculum while helping students meet the ELA CCSS. I researched and found picturebooks that are appropriate to present third grade science concepts and have compiled a handbook that correlates the texts found to the science standards and offers ways to help teachers integrate the ELA CCSS. When selecting books for my handbook I searched for books that were rich in content. Often times, information in picturebooks can lead to confusion among students because it is not always accurate. I ensured the books I selected would not lead to confusion amongst students. Choosing quality literature that has been nationally recognized or awarded was a concern of mine because teachers often choose literature to share in their classroom, but it might not be quality literature. Students need to be exposed to quality literature in order for them to be enriched by those books. The handbook I have created is broken down into the four bodies of knowledge for the third grade science NGSSS, it then goes on to list the benchmarks included in each topic. It includes lists of books teachers can use to supplement their teaching of the specific concepts at hand, as well as activities that go along with the books. The activities integrate the ELA CCSS within them.

The following steps were conducted to complete my project.

- Conducted research on effective use of children's literature in science instruction (June-July 2013)
- Conducted research on the Common Core State Standards (July-August 2013)
 - Focused on ELA CCSS
 - Researched methods for integrating ELA CCSS into science instruction
- Conducted search of children's literature appropriate for use in 3rd grade science instruction (August-September 2013)
- Compiled a list of children's literature (picture and informational; focusing on texts that have been nationally recognized or award winners) that correlate to the third grade Next Generation Sunshine State Standards for science (August-September 2013)
- Began writing thesis (October-November 2013)
- Created a handbook (October-November 2013)
 - The handbook has categorized third grade science standards, linked them to related children's literature and offers methods for integrating and helping students meet the ELA CCSS
 - Information such as: title, author, awards (if applicable), and a short summary for each book are included in the handbook
- Thesis Defense (November 2013)

CHAPTER FOUR: RESEARCH RESULTS

Taking a look at the research that has been conducted on using children's literature to enhance science instruction was very informative. The purpose of this research was to determine whether using children's literature in the science curriculum is beneficial to students. In order to understand whether or not students benefit from teachers using children's literature to teach science concepts I reviewed studies, examined a program that incorporates children's literature in their classrooms, and studied research that supports using children's literature in science curricula.

Broemmel and Rearden (2006) showed that using high quality picturebooks in the classroom has a positive effect on student achievement. They conducted a study where a classroom used a literature-based program integrated with science instruction as opposed to a control group and literature-only classroom. They found the students in the literature-based program scored higher on all literacy measures and on two out of three science measures. Approximately 80% of the students in the literature-based program claimed they enjoyed science as opposed to the 40% in the other two groups.

"ScienceStart!" is another program I reviewed during the research process and found it was very successful. The program is geared towards preschoolers and exposes them to narrative and informational picture books. A pre and posttest was given to the students and it showed significant learning gains after a seven-month period of students participating in the program (Leung, 2008).

I investigated how the Common Core State Standards (CCSS) for science and English language arts are intertwined. Teachers often do not know how to go about meshing the two together, but if done so correctly, it can be a powerful tool. Teachers need to use cross-curricular methods to teach science and English language arts. For example, they could complete language arts activities using science content. That way students are being exposed to richer and rigorous learning opportunities. The Next Generation Science Standards (NGSS) are a framework that defines science learning. These standards are a progressive approach to teaching science. The NGSS are a big change from the traditional standards because they now integrate three dimensions of science content, science practices, and big picture themes. The ELA standards expect students to read, write and talk about various topics, while the science standards expect students to ask questions and interpret data. These are things teachers can have students do throughout all science disciplines. Language learning and science learning go hand in hand because in order to learn and read about science concepts, students need to be able to comprehend and retain what they are reading and learning about (Lee, Quinn, & Valdes, 2013).

After reviewing the Broemmel and Rearden (2006) and “ScienceStart!” studies I have come to the conclusion that using children’s literature to enhance science education is a positive way to teach science concepts and engage students. Students not only gravitate towards picturebooks but they are also able to comprehend abstract ideas and information when it is presented in a kid-friendly way (Gwekwerere & Buley,

2011). Students also turn into active learners when they use picturebooks to learn new concepts (Shelley, 2007).

I have also found that children's literature whether fiction or nonfiction is beneficial to students because it peaks student interests. When teaching a core subject, such as science, making the content interesting and fun for students is important. Picturebooks are a great alternative to using textbooks. My handbook shows third grade teachers how to use children's literature in innovative ways and how to incorporate them in science curricula.

The handbook (see Appendices A-D) includes activities that relate to the third grade science benchmarks. It is formatted so that teachers can read and understand the information easily. It includes the four bodies of knowledge, which are Life Science, Earth and Space Science, Physical Science, and Nature of Science. The eleven big ideas and benchmarks are also organized in the handbook.

For example, within the Earth and space science body of knowledge and Earth in space in time big idea (see Appendix B), I have included four books that teachers can use to teach the concepts included under that big idea: *How Many Stars in the Sky?* (Hort & Ransome, 1997), *Gravity is a Mystery* (Branley & Miller, 2007), *Why the Sun and Moon Live in the Sky* (Dayrell & Lent, 1990), and *Stars* (Ray & Frazee, 2011). The concepts include: explaining that stars are different, identifying the sun as a star that emits energy, recognizing that the sun appears large and bright because it is closest to the sun, the law of gravity, and how stars can be seen through telescopes. I have also

included two activities that relate to the books I listed, teachers can use in their classrooms to reinforce the concepts. The activities, as listed in Appendix B, are a writing assignment that relates to stars and a group activity that includes organizing information about gravity into a graphic organizer. The CCSS that correlates with the writing assignment is “CCSS.ELA-Literacy.RL.3.6 Distinguish their own point of view from that of a narrator or those of the characters”. It relates because for the activity students are to think of themselves as a star, like in the story, but they need to have a point of view on what they would do, as a star.

CHAPTER FIVE: CONCLUSION

Getting students interested in learning is the most important thing when in the classroom. Having students engaged and actively learning when teaching science is essential in order to have a successful classroom environment. ESOL students benefit from the use of picturebooks as much as other students because they provide a way to communicate information through illustrations or photographs. When I first began my research, I did not know whether or not using picturebooks in the classroom had been proven to be effective.

The purpose of this research was to determine whether using picturebooks to teach science curriculum had a positive impact on student achievement. After looking at the studies mentioned above, I have come to the conclusion that students benefit from using picturebooks in science curriculum. Students are more engaged when learning new concepts from a picturebook than from a textbook. As educators, we need to move toward using literature throughout all disciplines of education.

Teaching students by using picturebooks has many positive outcomes on student achievement. After researching, I found students are more attentive when a teacher uses picturebooks to teach science concepts versus using a textbook. Teachers who want to use picturebooks for science instruction need to focus in on a few key factors. This is particularly important when choosing picturebooks that will come out in the future. Choosing quality literature is very important because as educators, we need to expose our students to picturebooks that are rich in content. Teachers also need to be

weary of picturebooks that have misleading information in them. Using picturebooks that have incorrect facts in them can cause a great deal of confusion amongst students.

An obstacle teachers face when selecting picturebooks is that they are often unsure of when it is appropriate to use fiction or nonfiction when teaching science. If a teacher wants to delve deeper and focus in on one aspect of a certain concept he/she should use nonfiction text. Fiction text is typically used when introducing a new science concept/skill. It is a starting point for teachers, where they can engage their students in deeper discussions about a particular skill.

After conducting my research on using picturebooks to teach science concepts, I have learned that there is a multitude of ways to teach science. I believe I have become a better teacher after this process because I not only feel more knowledgeable about how to teach science but also how to get students engaged and excited to learn. I have come across quality picturebooks that can be used in various different ways and activities that go along with them. I now believe I have the tools necessary to teach science and to make a lasting impression on students.

Further Research Ideas

After researching these past ten months, I have learned a great deal about using children's literature to teach science concepts in the classroom, but I also have many unanswered questions. Would using children's literature to enhance math and social studies be beneficial? How can teachers successfully incorporate using picturebooks to teach various subjects? Should we get rid of textbooks altogether and use children's

literature to teach? These are all important topics that are a good starting base for future research.

**APPENDIX A: HANDBOOK CONTENTS FOR:
BODY OF KNOWLEDGE- NATURE OF SCIENCE**

Nature of Science

Big Idea 1: The Practice of Science

A: Scientific inquiry is a multifaceted activity; The processes of science include the formulation of scientifically investigable questions, construction of investigations into those questions, the collection of appropriate data, the evaluation of the meaning of those data, and the communication of this evaluation.

B: The processes of science frequently do not correspond to the traditional portrayal of "the scientific method."

C: Scientific argumentation is a necessary part of scientific inquiry and plays an important role in the generation and validation of scientific knowledge.

D: Scientific knowledge is based on observation and inference; it is important to recognize that these are very different things. Not only does science require creativity in its methods and processes, but also in its questions and explanations.

SC.3.N.1.1

Raise questions about the natural world, investigate them individually and in teams through free exploration and systematic investigations, and generate appropriate explanations based on those explorations.

Cognitive Complexity/Depth of Knowledge Rating: High

SC.3.N.1.2

Compare the observations made by different groups using the same tools and seek reasons to explain the differences across groups.

Cognitive Complexity/Depth of Knowledge Rating: High

SC.3.N.1.3

Keep records as appropriate, such as pictorial, written, or simple charts and graphs, of investigations conducted.

Cognitive Complexity/Depth of Knowledge Rating: Moderate

SC.3.N.1.4

Recognize the importance of communication among scientists.

Cognitive Complexity/Depth of Knowledge Rating: Moderate

SC.3.N.1.5

Recognize that scientists question, discuss, and check each others' evidence and explanations.

Cognitive Complexity/Depth of Knowledge Rating: Moderate

SC.3.N.1.6

Infer based on observation.

Cognitive Complexity/Depth of Knowledge Rating: High

SC.3.N.1.7

Explain that empirical evidence is information, such as observations or measurements that is used to help validate explanations of natural phenomena.

Cognitive Complexity/Depth of Knowledge Rating: High

Books

-Citizen Scientists: Be a Part of Scientific Discovery from Your Own Backyard by Loree Griffin Burns (2012)

This informational picturebook discusses how everyone can be a scientist. It encourages children to go out into the world and discover unknown things. (Nonfiction)

-What is Science? by Rebecca Kai Dotlich (2006)

This poetic picturebook discusses how science is much more than rocks and planets. It tells the reader how science is about inquiry and curiosity and finding answers to unanswered questions. (Nonfiction)

-In the Snow: Who's Been Here? by Lindsay Barrett George (1999)

This picturebook is about children who are going sledding but see animal tracks on their way. The kids must infer to figure out which animal had been in the snow, based on clues the author gives. (Fiction)

-Measuring Penny by Loreen Leedy (2000)

This picturebook is about a girl names Lisa, who has a homework assignment where she needs to measure something in numerous ways. She decides to measure her dog, Penny, and learns a lot about height, width, length, volume, and temperature. (Fiction)

Activities

- Have students use their observational and inferencing skills to complete an activity similar to the storyline in, *In the Snow: Who's Been Here?* The teacher

should have pictures of animal tracks in the snow, dirt, and mud. The objective is for students to look at the tracks and what type of environment is shown to infer which animal the tracks belong to.

- Have students be scientists and conduct an experiment (any basic, short experiment). The “scientists” should use the skills they learned about in any of the stories above and apply them. Students should display data in multiple ways (graph, written form, etc.), they should communicate effectively with other “scientists”, and compare data with them.

Big Idea 3: The Role of Theories, Laws, Hypotheses, and Models

The terms that describe examples of scientific knowledge, for example; "theory," "law," "hypothesis," and "model" have very specific meanings and functions within science.

SC.3.N.3.1

Recognize that words in science can have different or more specific meanings than their use in everyday language; for example, energy, cell, heat/cold, and evidence.

Cognitive Complexity/Depth of Knowledge Rating: Moderate

SC.3.N.3.2

Recognize that scientists use models to help understand and explain how things work.

Cognitive Complexity/Depth of Knowledge Rating: Low

SC.3.N.3.3

Recognize that all models are approximations of natural phenomena; as such, they do not perfectly account for all observations.

Cognitive Complexity/Depth of Knowledge Rating: Moderate

Books

-Being a Scientist by Natalie Lunis (1999)

This informational picture book talks about all the things scientists do. It explains how they communicate, predict and make models. (Nonfiction)

-Let's Experiment by Natalie Lunis (2007)

This informational picturebook is about all the things that go into an experiment. It tells students the importance of questions, hypotheses, observations, and conclusions. (Nonfiction)

Activities

- Have students complete a writing activity where they are a scientist and need to lead a team to successfully complete an experiment. The “scientists” job is to ensure he/she follows proper procedures, they learned about in the books above. The students need to refer back to the book, in their writing. The “scientist” needs to accurately create hypotheses, communicate with the team, make observations, record data and analyze the results. The students are to describe how it feels to be a scientist leading a group of researchers and identify what scientists need to do in order to have a successful experiment.

(**CCSS.ELA-Literacy.RL.3.5** Refer to parts of stories, dramas, and poems when writing or speaking about a text, using terms such as chapter, scene, and stanza; describe how each successive part builds on earlier sections.)

**APPENDIX B: HANDBOOK CONTENTS FOR:
BODY OF KNOWLEDGE- EARTH AND SPACE SCIENCE**

Earth and Space Science

Big Idea 5: Earth in Space and Time

Humans continue to explore Earth's place in space. Gravity and energy influence the formation of galaxies, including our own Milky Way Galaxy, stars, the Solar System, and Earth. Humankind's need to explore continues to lead to the development of knowledge and understanding of our Solar System.

SC.3.E.5.1

Explain that stars can be different; some are smaller, some are larger, and some appear brighter than others; all except the Sun are so far away that they look like points of light.
Cognitive Complexity/Depth of Knowledge Rating: High

SC.3.E.5.2

Identify the Sun as a star that emits energy; some of it in the form of light.
Cognitive Complexity/Depth of Knowledge Rating: Moderate

SC.3.E.5.3

Recognize that the Sun appears large and bright because it is the closest star to Earth.
Cognitive Complexity/Depth of Knowledge Rating: High

SC.3.E.5.4

Explore the Law of Gravity by demonstrating that gravity is a force that can be overcome.
Cognitive Complexity/Depth of Knowledge Rating: High

SC.3.E.5.5

Investigate that the number of stars that can be seen through telescopes is dramatically greater than those seen by the unaided eye.
Cognitive Complexity/Depth of Knowledge Rating: Moderate

Books

-How Many Stars in the Sky? By Lenny Hort (1997)

In this picturebook, a mother is away one night, and her son can't sleep. He tries counting the stars but he ends up wanting to count them all. The boy finds that his dad cannot sleep either, so they decide to stay up and gaze at the stars. The boy and his father spend the night making discoveries. (Fiction)

-Gravity is a Mystery by Franklyn M. Branley (2007)

This informational picturebook is about a scientist and his dog and how they help students understand gravity and the “mysteries” that surround it. (Nonfiction)

-Why the Sun and Moon Live in the Sky by Niki Daly (1995)

This picturebook is a story about how the sun and the moon lived on the earth, until the sun invited the sea to visit. (Fiction)

-Stars by Mary Lyn Ray and Marla Frazee (2011)

This picturebook explores stars and all the places they may be, whether it is in the sky or in your pocket. (Fiction)

Activities

-Have students write a story about themselves being a star. Have them explain where they would shine and how far away they would be from Earth. After reading any of the books above and discussing stars, students should have knowledge about stars and how they come in different sizes.

(**CCSS.ELA-Literacy.RL.3.6** Distinguish their own point of view from that of the narrator or those of the characters.)

-Have student’s pair up and discuss what gravity is, after reading *Gravity is a Mystery*. They should create a bubble map, which includes details from the story that support what gravity is and how it affects them.

Big Idea 6: Earth Structures

Humans continue to explore the composition and structure of the surface of the Earth. External sources of energy have continuously altered the features of Earth by means of both constructive and destructive forces. All life, including human civilization, is dependent on Earth's water and natural resources.

SC.3.E.6.1

Demonstrate that radiant energy from the Sun can heat objects and when the Sun is not present, heat may be lost.

Cognitive Complexity/Depth of Knowledge Rating: High

Books

-The Day the Sun Went Out: The Sun's Energy by Angela Royston (2005)

This Informational book discusses how we depend on the sun for heat and light. It explains how the sun works and its properties. (Nonfiction)

Activities

-Have students write as if they were in the story, and about what they would do if the sun disappeared for one day. Have them think in scientific terms, based on the book above. (Do this writing assignment using RAFT form)

(**CCSS.ELA-Literacy.RL.3.6** Distinguish their own point of view from that of the narrator or those of the characters.)

- Have students come up with an example of a time the sun heated an object (could be fictional). They should write why it was important for the sun to heat the object and what would have happened if the sun were not present. Have students get creative and come up with fictional stories. It is important that they have their scientific facts correct, aside from that they can make up stories and objects.

**APPENDIX C: HANDBOOK CONTENTS FOR:
BODY OF KNOWLEDGE- PHYSICAL SCIENCE**

Physical Science

Big Idea 8: Properties of Matter

A. All objects and substances in the world are made of matter. Matter has two fundamental properties: matter takes up space and matter has mass.

B. Objects and substances can be classified by their physical and chemical properties.

Mass is the amount of matter (or "stuff") in an object. Weight, on the other hand, is the measure of force of attraction (gravitational force) between an object and Earth.

The concepts of mass and weight are complicated and potentially confusing to elementary students. Hence, the more familiar term of "weight" is recommended for use to stand for both mass and weight in grades K-5. By grades 6-8, students are expected to understand the distinction between mass and weight, and use them appropriately.

SC.3.P.8.1

Measure and compare temperatures of various samples of solids and liquids.

Cognitive Complexity/Depth of Knowledge Rating: Moderate

SC.3.P.8.2

Measure and compare the mass and volume of solids and liquids.

Cognitive Complexity/Depth of Knowledge Rating: Moderate

SC.3.P.8.3

Compare materials and objects according to properties such as size, shape, color, texture, and hardness.

Cognitive Complexity/Depth of Knowledge Rating: Moderate

Books

-What is the World Made of? All about Solids, Liquids, and Gases by Kathleen Zoehfeld (1998)

This informational picturebook discusses the differences in solids, liquids, and gases. It explains, in kid-friendly terms, how these 3 states of matter affect their life. (Nonfiction)

-Solid, Liquid, or Gas? by Sally Hewitt (1998)

This picturebook allows the reader to classify objects based on physical properties and the materials the objects are made of. (Nonfiction)

Activities

-After reading either book (above) conduct an experiment with your students using a bath fizz ball (bath bomb). Discuss the properties of solids, liquids, and gases and have students make a prediction as to what will happen when you drop the fizz ball (solid) into water (liquid). Students should be thinking about how when you mix a solid with a liquid, it creates a gas. Drop the fizz ball into the water and watch what happens. It will fizz up just like gas going into the air. Have students analyze the results and understand how the solid (fizz ball) and liquid (water) created a gas.

-Have student's pair up and look at the illustrations and text in the book *Solid, Liquid, or Gas?* They should classify the objects into groups of solids, liquids, and gases based on their physical properties. The teacher will need to photocopy pages from this book, to pass out to each pair of students.

(**CCSS.ELA-Literacy.RL.3.7** Explain how specific aspects of a text's illustrations contribute to what is conveyed by the words in a story (e.g., create mood, emphasize aspects of a character or setting))

Big Idea 9: Changes in Matter

A. Matter can undergo a variety of changes.

B. Matter can be changed physically or chemically.

SC.3.P.9.1

Describe the changes water undergoes when it changes state through heating and cooling by using familiar scientific terms such as melting, freezing, boiling, evaporation, and condensation.

Cognitive Complexity/Depth of Knowledge Rating: Moderate

Books

-How Water Changes by Jim Mezzanotte (2006)

This informational picturebook discusses how water changes to all three states of matter. (Nonfiction)

-Freezing and Melting by Robin Nelson (2003)

This informational picturebook discusses how water changes from a solid to a liquid, and can go back and forth between the two states of matter. (Nonfiction)

-The Snowy Day by Ezra Jack Keats (1976)

This picturebook is about a boy that discovers snow has fallen overnight. He spends his day playing in the snow and getting into mini adventures. (Fiction)

Activities

-Using the book *Freezing and Melting* have students investigate how water changes form. Fill up a paper cup with water and mark a line to distinguish the level of water. Place it in the freezer overnight, and take it out the next morning with the students. Rip off the paper cup, so you just have a block of ice. Place it in a plate or tray and observe what happens to the block throughout the day. Have students come up with ideas of what happened to the block of ice.

-The teacher should make bowls of snow. There should be enough for each pair of students to have one bowl to observe. (Directions here: <http://www.kidzworld.com/article/27714-science-project-make-your-own-snow#>) After reading *The Snowy Day* have students predict what they think will happen to the snow. The snow will melt and become water, but students should write their hypotheses down. Once they have seen what happened to the snow have them explain why it turned into water and the changes the snow had to undergo, in order to become water.

Big Idea 10: Forms of Energy

A. Energy is involved in all physical processes and is a unifying concept in many areas of science.

B. Energy exists in many forms and has the ability to do work or cause a change.

SC.3.P.10.1

Identify some basic forms of energy such as light, heat, sound, electrical, and mechanical.

Cognitive Complexity/Depth of Knowledge Rating: Low

SC.3.P.10.2

Recognize that energy has the ability to cause motion or create change.

Cognitive Complexity/Depth of Knowledge Rating: Low

SC.3.P.10.3

Demonstrate that light travels in a straight line until it strikes an object or travels from one medium to another.

Cognitive Complexity/Depth of Knowledge Rating: Moderate

SC.3.P.10.4

Demonstrate that light can be reflected, refracted, and absorbed.

Cognitive Complexity/Depth of Knowledge Rating: Moderate

Books

- **Day Light, Night Light: Where Light Comes From** by Franklyn M. Branley (1998)

This picturebook discusses the properties of light such as reflective light and speed of light. (Fiction)

- **Energy: Heat, Light, and Fuel** by Darlene Stille (2004)

This picturebook discusses where energy comes from, how it gets things done, and how to conserve energy. (Fiction)

- **Why Should I Save Energy?** by Jen Green (2005)

This picturebook is about how kids take energy for granted, until their community has a blackout. They learn all the ways energy is used in day-to-day life and how important it is to conserve it. (Fiction)

Activities

-After reading *Why Should I Save Energy?*, have students write about why the boys and girls in the story thought it was important to conserve energy. Students should think about what life would be like if there was no energy to provide us with basic necessities we need to live life. Tell students to put themselves in the kids' shoes and

think about how they would react if a blackout occurred where they lived. What would they do and how would they react?

(**CCSS.ELA-Literacy.RL.3.6** Distinguish their own point of view from that of the narrator or those of the characters.)

(**CCSS.ELA-Literacy.RL.3.3** Describe characters in a story (e.g., their traits, motivations, or feelings) and explain how their actions contribute to the sequence of events)

-Conduct an experiment about reflective light. Put students into pairs and give them one flashlight and one small mirror. The students will need to shine light on an object/area without directly pointing the flashlight at it. They will need to point the flashlight at the mirror, which will bounce the light off of it and reflect it on a certain area/object. The teacher should be asking students questions like “Does the light from the flashlight go through the mirror?” and “Where does the light go after it bounces off the mirror?” Students will need to record their findings and discuss the results with their partner.

Big Idea 11: Energy Transfer and Transformations

- A. Waves involve a transfer of energy without a transfer of matter.**
- B. Water and sound waves transfer energy through a material.**
- C. Light waves can travel through a vacuum and through matter.**

SC.3.P.11.1

Investigate, observe, and explain that things that give off light often also give off heat.
Cognitive Complexity/Depth of Knowledge Rating: High

SC.3.P.11.2

Investigate, observe, and explain that heat is produced when one object rubs against another, such as rubbing one's hands together.
Cognitive Complexity/Depth of Knowledge Rating: High

Books

-**Heat** by Ian F. Mahaney (2007)

This informational picturebook discusses how heat affects different things in our world and three different ways it is transferred. (Nonfiction)

-**The Magic School Bus in the Arctic: A Book About Heat** by Joanna Cole (1998)

This picturebook is about how Ms. Frizzle and her class travel to the Arctic and learn the basic concepts of heat and heat loss. (Faction)

Activities

-After reading *The Magic School Bus in the Arctic: A Book About Heat* story have students pair up and discuss how heat can be transferred. Guide students into thinking about what they read and how the students in the story warmed up after being in the Arctic. Have the pairs of students come up with another idea on how one would transfer heat. The teacher should give the example of how rubbing your hands together creates heat. That will give students an idea of how heat is transferred in real-life, and they may acknowledge they have done that at some point as well.

**APPENDIX D: HANDBOOK CONTENTS FOR:
BODY OF KNOWLEDGE- LIFE SCIENCE**

Life Science

Big Idea 14: Organization and Development of Living Organisms

- A. All plants and animals, including humans, are alike in some ways and different in others.**
- B. All plants and animals, including humans, have internal parts and external structures that function to keep them alive and help them grow and reproduce.**
- C. Humans can better understand the natural world through careful observation.**

SC.3.L.14.1

Describe structures in plants and their roles in food production, support, water and nutrient transport, and reproduction.

Cognitive Complexity/Depth of Knowledge Rating: Moderate

SC.3.L.14.2

Investigate and describe how plants respond to stimuli (heat, light, gravity), such as the way plant stems grow toward light and their roots grow downward in response to gravity.

Cognitive Complexity/Depth of Knowledge Rating: High

Books

-From Seed to Plant by Gail Gibbons (1993)

This informational picturebook discusses how a seed grows into a plant.

Concepts like plant reproduction, seed dispersal, pollen transference, and seed germination are included in the text. (Nonfiction)

-How a Seed Grows by Helene Jordan (2000)

This picturebook discusses how a seed slowly turns into a plant. It includes the effect sunlight, water, and nutrients have on a plant. (Fiction)

Activities

-After reading either of the stories above, have students write about how seeds grow into plants, from a seeds perspective. Have students get into the mind of a seed and think about what it would feel like to go from a tiny seed into a beautiful plant. Students should explain the stages a seed goes through in order to become a plant.

(CCSS.ELA-Literacy.RL.3.6 Distinguish their own point of view from that of the narrator or those of the characters.)

- Conduct a lima bean experiment with students. Soak lima beans in water overnight, and give the wet beans to students the following day. Have them pull the bean apart so the coating comes off and they can see inside the bean. They should be able to see stored food and a baby plant (embryo) inside of it. Students can identify the food and baby plant inside the bean. Have them investigate and figure out why the bean stores food inside its seed.

Big Idea 15: Diversity and Evolution of Living Organisms

A. Earth is home to a great diversity of living things, but changes in the environment can affect their survival.

B. Individuals of the same kind often differ in their characteristics and sometimes the differences give individuals an advantage in surviving and reproducing.

SC.3.L.15.1

Classify animals into major groups (mammals, birds, reptiles, amphibians, fish, arthropods, vertebrates and invertebrates, those having live births and those which lay eggs) according to their physical characteristics and behaviors.

Cognitive Complexity/Depth of Knowledge Rating: Moderate

SC.3.L.15.2

Classify flowering and nonflowering plants into major groups such as those that produce seeds, or those like ferns and mosses that produce spores, according to their physical characteristics.

Cognitive Complexity/Depth of Knowledge Rating: Moderate

Books

-Fur and Feathers by Janet Halfmann (2010)

This picturebook discusses how animals have different needs depending on the type of animal it is. A little girl sews coats for various animals, but learns that each coat needs to be different depending on the animal. (Fiction)

-The Reason for a Flower by Ruth Heller (1999)

This informational picturebook discusses how plants produce seeds and the functions of the different parts of a plant. (Nonfiction)

Activities

- Have students look at the illustrations in the book and have them discuss what physical characteristics they see in the animals. Discuss the types of animals that were in the story and explain how they each belong to a major group (mammals, birds, reptiles, etc...). Have students relate what the story said to the illustrations, to help guide their answers. Use that discussion to guide students into an activity. Have students create a map of a zoo and place animals in areas based on what group they belong to.

(**CCSS.ELA-Literacy.RL.3.7** Explain how specific aspects of a text's illustrations contribute to what is conveyed by the words in a story (e.g., create mood, emphasize aspects of a character or setting))

-Have students explain how plants produce seeds and bring up what flowering and nonflowering plants are. Create a venn diagram, with the students, listing physical characteristics and naming plants that flower and some that do not.

Big Idea 17: Interdependence

A. Plants and animals, including humans, interact with and depend upon each other and their environment to satisfy their basic needs.

B. Both human activities and natural events can have major impacts on the environment.

C. Energy flows from the sun through producers to consumers.

SC.3.L.17.1

Describe how animals and plants respond to changing seasons.

Cognitive Complexity/Depth of Knowledge Rating: Moderate

SC.3.L.17.2

Recognize that plants use energy from the Sun, air, and water to make their own food.

Cognitive Complexity/Depth of Knowledge Rating: Low

Books

-Living Sunlight: How Plants Bring the Earth to Life by Molly Bang (2009)

This informational picturebook discusses the photosynthesis process in kid-friendly terms. (Fiction)

-Animals in Winter by Henrietta Bancroft (1996)

This picturebook discusses how animals adapt to harsh winter weather and what they do in order to protect themselves. (Fiction)

-Snow Rabbit, Spring Rabbit: A Book of Changing Seasons by Il Sung Na (2013)

This picturebook discusses how a rabbit adapts, hibernates, and migrates due to changes in seasons. (Fiction)

Activities

-After reading *Animals in Winter* or *Snow Rabbit, Spring Rabbit: A Book of Changing Seasons* have students create an animal that has to adapt due to weather changes (seasons). Have them explain why their animal has to change (location, food, etc.). Students should write 3-4 paragraphs using details and examples of why their animal has to adapt to different seasons and draw a picture of what their animal would look like.

- The teacher should have two plants to experiment with. Tell the class you will place one plant near a window and one in a dark area of the classroom. Have them come up with why you would place one near a window and one in the dark. After reading *Living Sunlight: How Plants Bring the Earth to Life* students should understand photosynthesis and why plants need sunlight. Once students understand you are placing one plant near a window so that it can get sunlight, which is its food place the plant near a window. Take the other plant and place it in the dark. Have students observe what happens to the plants for the span of one week. They should write one paragraph describing what happened to each plant and why one continued to grow while the other wilted.

*** The standard: “**CCSS.ELA-Literacy.RL.3.1** Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers.” should be demonstrated anytime the teacher reads one of the books mentioned throughout this handbook.

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Use knowledge of language and its conventions when writing, speaking, reading, or listening. L.3.3.A. Choose words and phrases for effect. Determine or clarify the meaning of unknown and multiple-meaning word and phrases based on grade 3 reading and content, choosing flexibly from a range of strategies. L.3.4.A. Use sentence-level context as a clue to the meaning of a word or phrase.