STRENGTHENING THE CONNECTION BETWEEN SCIENCE AND LITERACY THROUGH INQUIRY-BASED INVESTIGATIONS IN KINDERGARTEN

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A thesis submitted in partial fulfillment of the requirements for a baccalaureate degree in Childhood and Early Adolescent Education with honors in Childhood and Early Adolescent Education

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ABSTRACT

In many cases, kindergarten is the first school experience for young children and with that comes their first opportunity to be exposed to science instruction and develop an interest toward the subject. In my first semester as a kindergarten intern in the Professional Development School Partnership at The Pennsylvania State University, I noticed an absence of science instruction, not only in my kindergarten classroom, but in other classrooms as well. While realizing that there are many factors as to why science instruction is not present in the daily schedule of many classrooms, I conducted a document analysis in order to find ways that I could integrate science instruction that would make it meaningful to the students in my class. Through my own practitioner inquiry, I worked to strengthen the connection between science and literacy through the use of integrated investigations, science talks, read alouds, and student science journals. In this thesis, I will demonstrate how the connection between science and literacy can be strengthened through effective instruction and an inquiry-based approach to learning in kindergarten. I will then provide educators with recommendations based on what I have learned through research and practice. It is important to note that my focus shifts from integrating literacy during science instruction to integrating science during blocked literacy center time, with the addition of more meaningful science investigations. This shift was made based on what I have noticed throughout my implementation process.
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Lastly, I would like to thank the Professional Development School (PDS) at Penn State for giving me the opportunity to learn from my incredible mentor, Lisa Spock. Without your support and encouragement, both in and out of the classroom, this project would not have been possible.
Introduction: Integrating Science in Kindergarten in Meaningful Ways

Young children are naturally curious and have an innate desire to make sense of the world around them (NRC, 2007). It is our job as educators and parents of these young children to provide opportunities to investigate and engage in science in a way that is meaningful to them. It is important for teachers to view science, not as a separated subject, but as a valuable pathway in teaching subjects like literacy and mathematics. Unfortunately, due to the demands of standardized testing (Centolanza, 2004), time constraints (Cawelti, 2006), educator uneasiness with the subject (Tosun, 2000), lack of kindergarten science standards and assessment methods, as well as other factors, it is rare to see science instruction being implemented to its fullest potential, or even at all, at the kindergarten level.

Why No Science?

At this point in time science is not seen as a regular component of the daily schedule in many kindergarten classrooms (NRC, 2007). Stemming from the No Child Left Behind (NCLB) legislation in 2001, an increased emphasis has been placed on helping all children develop their literacy and math skills, leaving science and other subjects on the back burner (Cawelti, 2006). Due to the fact that “No Child Left Behind focused heavily on using reading and mathematics test scores to determine whether schools were making progress in reducing achievement gaps among various subgroups of students,” there was an increased pressure on educators to focus
solely on those very subjects (Cawelti, 2006, p. 1). With all of the pressure being put on educators to have their students succeed in reading and mathematics, it became routine for teachers to get discouraged from teaching material, like science, that their students would not be tested on.

For example, in a study of 376 elementary and secondary teachers in New Jersey, teachers indicated that they tended to teach to the test and often neglected individual students' needs because of the rigorous focus on high-stakes testing. In addition, these New Jersey teachers claimed that they had little time to teach creatively, and found themselves boring their students with practice problems as they were preparing students for standardized tests (Centolanza, 2004). From this study it was noted that the weight of standardized testing is demoralizing teachers from teaching how and what they are teaching their students; compromising science instruction once again.

As the NCLB legislation was recently replaced by the Every Student Succeeds Act (ESSA), I am hopeful that our nation will witness a positive change in the way teachers and students view science instruction. The ESSA “requires—for the first time—that all students in America be taught to high academic standards that will prepare them to succeed in college and careers” (U.S. Department of Education, 2010, para. 5). It also “ensures that vital information is provided to educators, families, students, and communities through annual statewide assessments that measure students' progress toward those high standards” (U.S. Department of Education, 2010, para. 5).

Another factor that contributes to a lack of science instruction is the lack of kindergarten science standards in the state of Pennsylvania. Right now, the state has adopted its own version of Common Core Standards, which focuses exclusively on academic expectations in the areas of
English language arts and mathematics in kindergarten. The fact that other subject areas are not included in this set of core standards sends a message to both teachers and students that subjects other than English language arts and mathematics are of a lesser priority in regards to classroom instruction. Although there are kindergarten science standards that are available to educators through the Pennsylvania Department of Education, the standards that are listed are extremely broad and give teachers little guidance in how to instruct and assess students in relation to the standards they provide. This could discourage teachers from feeling prepared and comfortable teaching the subject to their students on a regular basis.

Even in teacher preparation programs, the lack of confidence in science teaching has been acknowledged by a study conducted by Fairleigh Dickenson University (Tosun, 2000). The majority of pre-service elementary teachers at The University of Connecticut, where the study was conducted, do not feel as though they can effectively teach science in their classrooms. This study looked closely at the correlation between their personal achievement in science courses and their overall attitude towards the subject as a teacher of science. Results of the descriptors used by study participants were overwhelmingly negative, suggesting that negative feelings about the subject of science overshadow personal achievement in science as an influence on an educator’s science teaching self-efficacy (Tosun, 2000).

Why Science in Kindergarten?

According to the Next Generation Science Standard website (2013), colleges and universities focus on student performance at the end of a student’s high school experience. Instead of focusing on test scores at the end of a students’ public school experience, many people
believe that the focus should be on what *educators* can do to support children. Science education research has found that using an inquiry lens during science instruction has been helpful in supporting meaningful learning for students. This lens includes implementing investigations that are comparable to real-world experiences that students will likely encounter in Science, Technology, Engineering and Math (STEM) occupations. These investigations loosely follow the fundamental components of the inquiry cycle. The inquiry cycle in Figure 1 represents the very practices that many scientists engage in when they are working in the field. Introducing students to this cycle at a young age may allow students to feel comfortable engaging in the cycle across disciplines, whether it be in the field of science or not.

![Inquiry Cycle](image)

Source: Wolkenhauer, 2016, Slide 3

Over the past few decades, there has been a drastic shift in the need for skilled and educated workers in the areas of STEM. According to the United States Department of Education, “The United States is falling behind internationally, ranking 29th in math and 22nd in science among industrialized nations. What’s more, a recent survey revealed that only 29 percent of Americans rated this country’s K-12 education in STEM subjects as above average or the best
in the world. In our competitive global economy, this situation is unacceptable” (Science, Technology, Engineering and Math: Education for Global Leadership, 2015).

There is an increasing push for STEM education in our schools, but the standards in place to support the push are outdated and not sufficient to ensure that teachers have the resources and guidelines in order to prepare their students for this drastic shift. Figure 2 highlights the percentage of job growth increases by the year 2020. Students should be prepared to step into these jobs with confidence and purpose to change the world through innovation. Without the encouragement and confidence in their ability to learn and engage in science, our nation will continue to fall behind in science innovation.

Figure 2 STEM Job Increases

![Graph showing projected percentage increases in STEM jobs: 2010-2020](http://www.ed.gov/stem)

Summary

This thesis will explain my personal experiences as a kindergarten intern in the Aviary School District. I will outline the processes that I used to implement integrated science investigations and will give educators recommendations for implementing science instruction into their own classrooms. In addition, I will provide evidence to support the claim that science and literacy are connected, and this connection can be enhanced in a variety of ways.
Rationale: Instructional Context

According to the National Research Council (NRC), “Many adults, including educators, tend to underestimate children’s capacity to learn science core ideas and practices in the early years and fail to provide the opportunities and experiences for them to foster science skills and build conceptual understanding” (NRC, 2007, p. vii). Similarly according to the National Science Teachers Association (NSTA), Early Childhood Position Statement, “…underestimated is the length of time that young children are able to focus on science explorations” (NSTA Position Statement, 2014, p.1). Providing students with opportunities to investigate phenomena that puzzle them can create opportunities for young learners to form wonderings about the natural world, make predictions, and justify their claims based on evidence through explanation and documentation. I believe that it is my responsibility as an educator to lay the foundation for science education at a young age so that students do not see science as a subject that is isolated from others.

Pre-Student Teaching Science Experiences

After taking 9 credits of specialized science content courses for future educators, through Penn State’s College of Education, and a science methods course through the Professional Development School (PDS) partnership, I have learned that kindergarten students are more than capable of learning and engaging in science investigations. Throughout my educational experiences at Penn State in regard to teacher preparation in the subject of science, I have been taught to engage students with an inquiry-based approach to learning.
Additionally, my experiences in the Teaching Elementary Science Leadership Academy (TESLA) at The Pennsylvania State University and its partnership with the Discovery Space children’s hands-on science museum, located in downtown State College, has given me experiences engaging students in science investigations prior to my student teaching experience in the PDS. TESLA is comprised of a selected group of Penn State College of Education students who demonstrate a passion in improving science teaching in classrooms as well as in the community. During my sophomore and junior year, TESLA afforded me the opportunity to engage a small group of children (ages 5-9) in informal science investigations on a bi-weekly basis. This collaborative group was known as the Discovery Space “Kids Advisory Board.” We would spend an hour engaging children in interesting investigations and a half an hour having them critique children’s exhibits in the museum to make them more appealing for museum goers of their age. Their feedback was taken into consideration, and most of the time, resulted in changes that they could see in the museum. I witnessed the children’s interests in science grow over time. Based on my personal experiences running the Kid’s Advisory Board for two years, I know that young children are in fact capable of learning science concepts when they are presented in a fun way that is central to what they are wondering about.

The Professional Development School (PDS) Aviary School District Partnership

Interning in a kindergarten classroom at Bluebird Elementary, in the Aviary School District, through the Professional Development School (PDS), has given me the opportunity to spend a whole year in the same classroom with the same group of students from the first day of school to the last. After applying to be a part of this unique yearlong internship program, I was
chosen as one of 54 Pennsylvania State Elementary Education majors to participate in a partnership between The Pennsylvania State University and the Aviary School District. The PDS prides itself on educating and supporting teachers to have an inquiry-oriented stance towards their practice. After just one semester of my student teaching experience with the PDS, I have been looking to systematically examine my practice and its impact on my students through classroom-based research in science, as well as other subjects.

The PDS program requires interns to have a partner classroom that is at least two grade levels away from their main placement to ensure that each intern gains sufficient experience observing and teaching students in other grades. After spending a great deal of time in my 3rd grade partner classroom, I was left wondering why I was seeing science instruction in the daily schedule there, but not in my kindergarten placement. I had learned through previous instruction and experience that young children are capable of learning science concepts and the practices that follow. This wondering inspired me to make a change in my classroom in consultation with my mentor teacher.

When looking at my kindergarten classroom’s daily schedule featured in Table 1, you will notice that a majority of our day is devoted to literacy and math instruction. Knowing that a main focus in kindergarten is teaching students how to read and write, my goal was to integrate science into our day, while also integrating the already existing components of our daily schedule into our investigations. I have been passionate and committed to exploring ways to improve my kindergarten students’ science experiences in the latter half of my student teaching experience and in my career going forward. My goal was not only to research the most effective ways to engage young learners in science, but also to research the benefits of strengthening the
connection between science and literacy through the use of inquiry-based investigations, science talks, read alouds and science journals.

Table 1 Kindergarten Schedule

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Inquiry-based Science Instruction & the Connection to Literacy

The PDS defines teacher inquiry as the systematic and intentional study by teachers of their own classroom practice. As an intern in the PDS, I am encouraged to engage in the inquiry
process every day in relation to my students and the reoccurring challenges I notice in my classroom. As previously mentioned, practitioner inquiry starts out with a general wondering and is driven by data, interest and purpose. Inquiry can also be used in other contexts and for other purposes, and that is part of the reason why I chose inquiry-based learning to engage my students in science.

The National Science Teachers Association recognizes that scientific inquiry is a powerful way to understand science content because students learn how to ask questions and find evidence to answer them (NSTA Position Statement, 2004). In this process, they are engaging in scientific practices that can feel natural and meaningful to them. Throughout the inquiry process students are learning to participate in investigations, gather evidence through a variety of ways, and explain their findings in order to defend what they have learned to others. These are the very same practices that scientists engage in on a daily basis in the real world.

Inquiry-based science is currently at the forefront of this national reform in science education. Additionally, “Inquiry-based science can provide a meaningful context for literacy activities in that it creates a motivating purpose for students to use language in order to negotiate meaning and figure out something new about the way the world works” (Zembal-Saul, 2013, p.11). There is significant intersection between scientific literacy in reading and writing, as well as speaking and listening, which are critical components of language and literacy. When taught thoughtfully and effectively, inquiry-based science can address and enhance these components of literacy. According to Pearson, “Science and literacy use many of the same reasoning processes: setting purposes, asking questions, clarifying ambiguities, drawing inferences from incomplete evidence, and making evidence-based arguments” (2010, p. 460). This clear connection between
inquiry, literacy, and science instruction provides another reason as to why I chose to engage my students through an inquiry-based approach to learning.

The Next Generation Science Standards (NGSS) were also important to my work. Lead States and Achieve authored these standards. The standards were developed through a multi-step, research-based process and were published in April 2013. The goal of the NGSS was to provide K–12 educators with standards that are “rich in content and practice, and arranged in a coherent manner across disciplines and grades to provide all students an internationally-benchmarked science education” (Final Release NGSS, 2013, p. 1). The standards were created in a way that each reflects three dimensions. These dimensions include:

**Dimension 1 - Scientific and Engineering Practices (SEP)**
- This dimension addresses the very practices that both scientists and engineers use in their respective fields.
- SEPs are not equivalent to the scientific method. The practices include iterative processes of constructing, critiquing, and using evidence-based explanations for phenomena.
* Note: The NGSS “uses the term ‘practices’ instead of a term such as “skills” to emphasize that engaging in scientific investigation requires not only skill but also knowledge that is specific to each practice” (“Final Release NGSS,” 2013, p. 2).

**Dimension 2 - Disciplinary Core Ideas (DCI)**
- This dimension provides students with “sufficient core knowledge so that they can later acquire additional information on their own” (“Final Release NGSS,” 2013, p. 2), whether it be later on in their educational career or through their personal experiences.
- This dimension focuses on science content.

**Dimension 3 - Cross-cutting Concepts (CC)**
- This dimension is in place to link core ideas that cut across other science disciplines ("Final Release NGSS," 2013).
- CCs include energy, patterns, causation, etc.

In most state and district standards, the three dimensions outlined above are presented as separate units, which ultimately leads to their separation in both instruction and assessment. The integration of rigorous content and its application reflects how science and engineering is practiced in the real world, which perfectly aligns with my beliefs about science education in kindergarten.
Methods: Preparing for Science and Literacy Integration

After discussing my desire to integrate science instruction into our classroom with my mentor teacher, we agreed that I would start by implementing one science investigation per week. I was extremely fortunate to have a mentor that gave me the time I needed in the classroom to give our 25 students meaningful science instruction. The investigations that I conducted ranged from 50 minutes to 2 hours long depending on the schedule for that week. These investigations were aligned to both Pennsylvania State Standards, the Aviary School District kindergarten science curriculum objectives, and the three dimensions of the NGSS framework. Lastly, I was intentional about maintaining and strengthening the connection of science and literacy. In planning, I leveraged the following instructional strategies to achieve integration:

1. Science Integration
2. Read Aloud Texts
3. Science Talks & Discussions
4. Student Science Journals
5. Visual Representation

Science Integration

Knowing that students benefit from learning content that is connected in some way to content that they have previously learned about, or are learning about in another discipline, has driven me to look for as many connections in my science teaching as possible. As previously mentioned, literacy and mathematics are a main focus at the kindergarten level. My goal was to integrate these subjects into every investigation that my class participated in, while also making
sure that my students were engaging in scientific practices and learning the outlined scientific concepts for that unit.

The National Research Council states, “while the standards in English language arts and science have been developed separately, there are areas where the standards intersect directly” (2014, p. 1). When looking at the standards side by side, I saw a clear correlation between the two. In a science investigation, the student is constantly constructing explanations based on the evidence they find, also students are responding to the read aloud that I provide at either the beginning or end of instruction. Students learn to listen to each other’s thoughts and explanations. They are also listening to read alouds and directions that pertain to a particular investigation. Moreover, I have been thoughtful about giving my students time to document their thoughts in their science journals as well. As you can see, literacy and all of its components can be captured in a single science lesson.

**Read Aloud Texts**

Pearson stated, “No scientist simply walks into a lab and starts manipulating materials, tools, and phenomena. Investigations are always framed by other investigations. Texts are the artifacts of those past investigations and are used for inductive reasoning about scientific phenomena. Scientists use texts to generate new research questions and to provide the background necessary for research design and investigation” (2010, p. 460). Pearson’s explanation accurately describes why I feel so strongly about showing my students the connection between science and literacy. I enjoy giving my students real world experiences, so they can see themselves as the young scientists they are. In achieving this goal, I have sought to
provide my students with literature connections that can deepen their understanding of a topic before, during and after my investigations. Research has demonstrated that without regular attention to reading and writing within areas like science and social studies, students will fail to understand what it means to use the tools of literacy for learning.

Supporting this notion, Pimentel suggested “...read alouds could be an important way to address limitations in reading among the youngest children, while also building their skills in listening and speaking” (NRC, 2014, p. 42). Read alouds are books that teachers read orally to their students in a whole group setting. These books are selected to be above the students’ independent reading level, but align with their listening level. Presenting students with read alouds that are science-based can open students up to a new way of looking at informational texts.

In a study conducted in the late 1980’s, researcher Christine Pappas sought to examine whether kindergarten children could retell specific linguistic features from a series of informational texts that the students were exposed to during science instruction in the classroom (Donovan, 2001). “Pappas found that not only could the children retell the texts that they had heard, but also they did so successfully employing genre-specific linguistic features ” (Donovan, 2001, p. 5). This study showed that exposing young learners to informational texts that relate to a given topic can help to enhance their scientific vocabulary and ability to view informational texts as tools for learning.
Science Talks and Discussion

In my science methods course in the PDS, a main focus of our class was focused on how to engage our students in investigations that provide opportunities for students to explain their thinking and reason with their ideas through science talks. These science talks can be teacher-facilitated, but are also used to encourage students to discuss and expand on one another’s thoughts. In my methods course we frequently discussed the benefits of using talk moves with our students.

As you can see from Table 2, these Talk Moves can be posed to children in ways that challenge and deepen their engagement with the content. They can elicit surprisingly complex and subject matter-specific reasoning by students who might not ordinarily be considered academically successful.

Talk moves allow the teacher to uncover more of what the student is thinking. Engaging students with this type of guided discussion covers many Common Core English Language Arts standards that are in place for kindergarten.
Student Science Journals

Much research has been done in regard to supporting children in documenting their thinking through the use of individualized science journals. Science journals can be used with students of all ages. They are used to provide students with a designated place to jot down thoughts about what they learned, predictions, observations, and drawings (with or without labeling), all based off what they noticed and grasped in an investigation.

According to Campbell and Fulton (2003), “It is the responsibility of the teacher to determine what is appropriate for the students to record. For example, it may be more realistic to expect drawings from first graders than the use of Venn diagrams” (p.6). Being that kindergarten
is a grade where students may be experiencing science for the first time and are not familiar with this form of writing and drawing, it is important to have reasonable expectations. Campbell and Fulton stress this importance of having reasonable expectations with respect to the grade level, background knowledge, and overall student comfortableness with the subject of science. Since, I naturally have high expectations for all of my learners, I was very curious to see what my students would produce in their first journal entry, so that I could use it to inform my expectations going forward.

Campbell and Fulton (2013) also state, “Notebooks become a tool for helping students become better observers, classifiers, questioners, and so on. Notebooks may guide the teacher in planning the process skills on which to focus. For example, if students are having difficulty noting details, the teacher may focus on technical drawings to address the skill of observation. If a teacher doesn’t have a clear understanding of the goals that are to be achieved, science becomes a series of activities rather than a connected investigation” (p. 11). This pushed me to specify exactly what science vocabulary I wanted my students to focus on during each investigation.

**Visual Representations of Learning**

Research suggests that the use of visual reinforcements can enhance comprehension and retention of scientific vocabulary for students. Since there is a large population of English language learners in my classroom, my goal was to provide them with as many visual models for scientific words as possible, so that they could attach meaning to. I was surprised to find that there was extensive research found in this area, supporting all students, not just English language
learners. Research supports the use of visual representations in the classroom because they can often help to reduce the cognitive load on the learner. This is due to the learner’s ability to construct cognitive schemas.

According to the schema theory, knowledge is stored in the learner’s long-term memory in schemas so that it is organized and accessible when needed (Chi et al., 1982). If the visual representation can be connected to a common schema that learners may have, but is introduced with a new scientific vocabulary word, it can reduce the cognitive load on the learner by expanding the already existing schema. Being that schemas help to organize and link relevant information together, labeling the visual with the vocabulary word will increase the likelihood that relevant information will later be available for related learning tasks (Glaser, 1990). Zembal-Saul (2013) agrees that adding classroom posters or other visuals in the classroom can serve as a reminder to students of how to construct scientific explanations. She states, “Visuals serve as a resource for students to help them understand how to justify their claims in their science writing” (p. 82). I was curious to see how the use of visual representations impacted my learners and their ability to conceptualize and use the scientific vocabulary outside of the investigation context, as well as in their science journal entries.
Implementation of Science & Literacy Instruction in Kindergarten

I began planning my investigations by first looking at the Pennsylvania State Department of Education (PDE) standards, while also keeping in mind what our current thematic unit was at the time of planning. When summarizing the PA kindergarten science standards, the subjects on which I focused were living and non-living things, life cycles, animals, weather, and various states of matter. After comparing these standards to my district's kindergarten science curriculum, located on the Aviary School District website, I noticed that my district focused on five main units of study that included the bolded units shown below in Table 3. You will notice that the kindergarten science standards provided by the Aviary School District website are broad (2015). I saw this as an opportunity to expand the listed objectives and push my students’ thinking even further.
Table 3 Aviary School District Kindergarten Science Curriculum

<table>
<thead>
<tr>
<th>Kindergarten Science Curriculum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Life and Health Sciences</td>
</tr>
<tr>
<td>The human body is made up of many parts.</td>
</tr>
<tr>
<td>People have many similarities and differences.</td>
</tr>
<tr>
<td>The human body has five special senses.</td>
</tr>
<tr>
<td>Caring for yourself is important to good health.</td>
</tr>
<tr>
<td>Light and Sound</td>
</tr>
<tr>
<td>Eyes are organs which enable us to see.</td>
</tr>
<tr>
<td>Light comes from light sources such as the sun, light bulbs, candles, lanterns, and fire.</td>
</tr>
<tr>
<td>Shadows are made when something blocks the light.</td>
</tr>
<tr>
<td>Color is a quality of light.</td>
</tr>
<tr>
<td>Ears are organs which enable us to hear.</td>
</tr>
<tr>
<td>There are many different kinds of sounds.</td>
</tr>
<tr>
<td>Sounds are made when objects vibrate.</td>
</tr>
<tr>
<td>Some sounds are useful to people.</td>
</tr>
<tr>
<td>Seasons</td>
</tr>
<tr>
<td>There are four seasons in a year.</td>
</tr>
<tr>
<td>There are changes in weather with each season.</td>
</tr>
<tr>
<td>Seasonal weather affects how we dress and live.</td>
</tr>
<tr>
<td>Plant and animal life is different during each season.</td>
</tr>
<tr>
<td>There are weeks and months in a calendar year.</td>
</tr>
<tr>
<td>Animals</td>
</tr>
<tr>
<td>There are many different kinds of animals.</td>
</tr>
<tr>
<td>All animals have the same basic needs.</td>
</tr>
<tr>
<td>Animals grow and change.</td>
</tr>
<tr>
<td>Animals help people in many ways.</td>
</tr>
<tr>
<td>Plants</td>
</tr>
<tr>
<td>Plants are living things.</td>
</tr>
<tr>
<td>There are many kinds of plants.</td>
</tr>
<tr>
<td>Plants have roots, stems, leaves, and flowers.</td>
</tr>
<tr>
<td>Many kinds of plants grow from seeds.</td>
</tr>
<tr>
<td>Plants are useful to people.</td>
</tr>
</tbody>
</table>

As you can see the units are followed by 4-8 bullets describing what students should know by the end of the year. Teachers are fortunate to have freedom in how we want to teach these units, but I noticed that many of the bullets about what students should know at the end of a unit are not very challenging. The curriculum also fails to give teachers recommendations on what and how to teach and assess the students in their classroom. I have found, in my own practice, how I can cover these standards, while expanding and creating opportunities for students to challenge themselves through an inquiry-based approach to learning.
## Integration in my own classroom

### Table 4 Investigation T.O.C.

| Week | Name of Investigation/ Title of Lesson Plan | Connection to Thematic Units in K | Literacy (PA Common Core Standards) | Three Dimensions of NGSS  
| Science and Engineering Practices (SEP)  
| Disciplinary Core Ideas (DCI)  
| Crosscutting Concepts (CC) |
|---|---|---|---|---|
| 1 | Rain Cloud in a Jar | Seasons / Weather | **Reading:** CC1.2.K.J Using words and phrases acquired through conversations reading and being read to and responding to texts.  
**Writing:** CC1.4.K.B Use a combination of drawing, dictating, and writing to focus on one specific topic.  
**Speaking & Listening:** CC1.5.K.A Participate in collaborative conversations with peers and adults in small and larger groups. | **SEP:** Asking questions, carrying out investigation, making observations, constructing explanations, and communicating information.  
**DCI:** ESS2.D Weather and Climate  
**CC:** Cause and Effect |
| 2 | Clouds & Precipitation Revisited | Seasons / Weather | **Reading:** CC1.2.K.F With prompting and support, ask and answer questions about unknown words in a text.  
**Writing:** CC.1.4.K.C With prompting and support, generate ideas and details to convey information that relates to the chosen topic.  
**Speaking & Listening:** CC.1.5.K.G Demonstrate command of the conventions of standard English when speaking, based on kindergarten level and content. | **SEP:** Asking questions, making observations, constructing explanations, and communicating information.  
**DCI:** ESS2.D Weather and Climate  
**CC:** Cause and Effect |
| 3 | Sink / Float Center | Transportation (Boat Week) | **Reading:** CC1.3.K.I. Determine or clarify the meaning of unknown words and phrases based upon grade level reading and content. | **SEP:** Asking questions, carrying out investigation, making observations, constructing explanations, and communicating information. |
|   |   | **Writing:**  
CC.1.4.K.W. With guidance and support recall information from experiences or gather information from provided sources to answer a question. | **DCI:** PS1.A Structures and Properties of Matter  
**CC:** Cause and Effect |
|---|---|---|---|
| 4 | **Air & Aviation** | **Reading:**  
CC.1.2.K.F. With prompting and support, ask and answer questions about unknown words in a text.  
**Writing:**  
CC.1.4.K.E. With prompting and support illustrate using details and dictate / write using descriptive words.  
**Speaking & Listening:**  
CC.1.5.K.A  
Participate in collaborative conversations with peers and adults in small and larger groups. | **SEP:** Carrying out investigation, making observations, Collecting data, and communicating information.  
**DCI:** PS3.C Relationship Between Energy and Forces  
**CC:** Cause and Effect |
| 5 | **Chemical Reactions** | **Reading:**  
CC.1.2.K.F. With prompting and support, ask and answer questions about unknown words in a text.  
**Writing:**  
CC.1.4.K.E. With prompting and support illustrate using details and dictate / write using descriptive words.  
**Speaking & Listening:**  
CC.1.5.K.G  
Demonstrates command of the conventions of standard English when speaking, based on kindergarten level and content. | **SEP:** Asking questions, carrying out investigation, making observations, constructing explanations, and communicating information.  
**DCI:** PS1.A Structures and Properties of Matter  
**CC:** Cause and Effect |
| 6 | **Mystery Box** | **Reading:**  
**SEP:** Asking questions, |   |
| 7 | **Oobleck** | Human Body: Senses  
Sink/Float Revisited  
Holidays & Celebrations (Dr. Seuss's birthday) | **Reading:**  
CC.1.3.K.J. Use words and phrases acquired through conversations, reading, and being read to and responding to text.  
**Writing:**  
CC.1.4.K.W. With guidance and support recall information from experiences or gather information from provided sources to answer a question.  
**Speaking & Listening:**  
CC.1.5.K.A.  
Participate in collaborative conversations with peers and adults in small and larger groups. | SEP: Asking questions, carrying out investigation, making observations, constructing explanations, and communicating information.  
DCI: PS1.A Structures and Properties of Matter  
CC: Cause and Effect |
| 8 | **Investigating Worms** | Living vs. Nonliving  
Measurement (Length)  
Human Body: Senses | **Reading:**  
CC.1.3.K.G. Making connections between illustrations and the text in a story.  
**Writing:**  
CC.1.4.K.C. With prompting and support, generate ideas and details to convey information that relates to the chosen topic.  
**Speaking & Listening:**  
CC.1.5.K.E  
Speak audibly and express thoughts, feelings, and ideas clearly. | SEP: Asking questions, carrying out investigation, making observations, constructing explanations, and communicating information.  
CC: Patterns |
|   | **Chemical Reactions** | Human Body: Senses Measurement (liquid) | **Reading:**  
CC.1.2.K.F. With prompting and support, ask and answer questions about unknown words in a text.  
**Writing:**  
CC.1.4.K.E. With prompting and support illustrate using details and dictate/write using descriptive words.  
**Speaking & Listening:**  
CC.1.5.K.G Demonstrates command of the conventions of standard English when speaking, based on kindergarten level and content. | **SEP:** Asking questions, carrying out investigation, making observations, constructing explanations, and communicating information.  
**DCI:** PS1.A Structures and Properties of Matter  
**CC:** Cause and Effect |
|---|---|---|---|---|
|   | **Building Bridges Engineering** | Transportation (learning about the UK and the Tower Bridge) Measurement (Length, Width, Height, & Weight) | **Reading:**  
CC.1.3.K.J. Use words and phrases acquired through conversations, reading, and being read to and responding to text.  
**Writing:**  
CC.1.4.K.C. With prompting and support, generate ideas and details to convey information that relates to the chosen topic.  
**Speaking & Listening:**  
CC.1.5.K.A Participate in collaborative conversations with peers and adults in small and larger groups. | **SEP:** Asking questions, carrying out investigation, making observations, constructing explanations, and communicating information.  
**DCI:** ETS1.A: Defining Engineering Problems  
**CC:** Cause and Effect |

Through my internship and thesis study, I often started my lessons by saying, “Okay scientists, it’s time to put our science hats on!” While saying this, students would actually pretend to put on a hat on their heads. This was to not only get them focused and ready to learn, but also to have them see themselves as the young scientists they are. In the beginning of the year my mentor teacher had asked our students what they thought a scientist looked like. She then read a book to our students that showed them that everyone can be a scientist, even them!
As I began to implement investigations in my classroom, I was sure to keep reinforcing this in a fun way.

After teaching a series of ten integrated science investigations, I will share my experiences for how I went about planning each week. In Table 4, featured above, you will find a content summary of the investigations that I have implemented on a weekly basis from the beginning of January 2016 to the beginning of April 2016. These lessons are formatted using a standard lesson plan format in the Taskstream™ online learning platform. The two investigation summaries below provide the reader with clear examples of how I have moved from integrating literacy in science to integrating science in literacy over the course of ten weeks. The other summaries can be found in Appendices A-H along with their corresponding plans.

**Focus on Literacy in Science (Investigation 7: Oobleck)**

I chose to lead my students in an oobleck investigation in honor of Dr. Seuss’s birthday. Although the investigation did not go as planned, I think the kids were engaged and had a lot of fun. I started out by reading a condensed version of *Bartholomew and the Oobleck*, by Dr. Seuss (1949), which I found online and edited slightly. Then I split students into four groups and gave them each their own oobleck cups (cups were pre-made). I had a plate of materials in the middle that they used to predict and test whether or not the object would sink or float in the oobleck. I found that this activity was very difficult for my students to do on their own. If I were to implement this investigation in the future, I would just have one big bowl of oobleck at each of the four tables. It would be easier to monitor student thinking and it would definitely make it less chaotic. I found that with each student having their own cup of oobleck, it was very messy and
students wanted to wash their hands every 2 minutes (as did I). I also found that students were having great difficulty retrieving the objects that sank to the bottom of their oobleck. Although there were many things I would do differently, the students had another experience recording their predictions and results in relation to a sink/float investigation. It was also fun for students to continue to use their senses, as they were able to touch and smell the oobleck, which was made of cornstarch, water and green food coloring.

After the investigation, I was able to bag the oobleck for each student to take home to share with his or her parents and siblings. The following day I had students coming in asking for the oobleck recipe so that they could make more oobleck at home.

Figure 3 Oobleck Read Aloud

Source: (Seuss, 1949)
Oobleck Science Investigation

Grades/Level: Kindergarten
Date to be Taught: Wednesday 3/3 1:05-1:50
Time Frame: 1 class periods, 45 Mins. per class.
Subject: Science
Topic: Oobleck - Slink & Float

Summary: Students will be engaged in part of Dr. Seuss's, Bartholomew and the Oobleck read aloud. Students will be introduced to the problem that the kingdom of Didd is in danger and needs to be cleaned up. In order to clean the kingdom up, we need to make sure we can walk across it. What materials can we lay down to walk across the oobleck? Oobleck will be at each center (4). Students will be presented with materials and they will first predict if they will sink or float in the oobleck. Then students will test the materials and document it on their recording sheets. Students will then write about what material they would use to walk across the kingdom in their science journals.

OUTCOMES/OBJECTIVES AND STANDARDS

Objectives/Learning Outcome: Students will be able to document their predictions on a worksheet by circling whether they think the item will sink or float in the oobleck. Students will be able to talk about what they are observing with their eyes, through discussion. Students will be able to document their thinking in the form of writing and drawing in their science journals.

Standards: PA- Pennsylvania Early Learning Standards
Key Learning Area: Science
Standard: Demonstrate understanding of the process of scientific inquiry
Indicator: SC 1.2 Collect, describe and record information
Indicator: SC 1.3 Use tools and equipment to explore objects
Indicator: SC 1.4 Make and verify predictions
Indicator: SC 1.5 Compare, contrast and classify objects and data
Indicator: SC 2.6 Use language that shows understanding of scientific principles
Indicator: SC 7.1 Participate in scientific investigations

Prerequisite Skills: Students will need to know how to follow directions.
Students will need to know how to make predictions.
Students will need to know what it means for an object to sink and float.
Students will need to know how to observe only using their eyes.

ASSESSMENT OF STUDENT LEARNING

Assessment Activities/Rubric: Student Predictions and Results Sheets
Student Science Journal Pages
Observation - Student participation & behavior

MATERIALS AND TECHNOLOGY

Student Materials: Regular pencil - prediction pages & science journal pages
Colored pencils - science journal pages
Oobleck predictions worksheet

Teacher Materials: Read aloud - Bartholomew and the Oobleck, Dr. Seuss
Focus on Science in Literacy (Investigation 10: Building Bridges Engineering)

Our building bridges engineering lesson tied in seamlessly with our transportation unit Around the World and Math Measurement unit. During the week that we conducted this investigation, our class was visiting the United Kingdom. While in the UK, our class spoke about the famous Tower Bridge that is located in London, England, as well as other popular attractions in the UK. With this, I thought it would be fun to conduct an engineering investigation that had to do with my students building their own bridges.

I began by gathering all sorts of materials for my students to use in their bridge designs. These materials included: Popsicle sticks, toilet paper rolls, pieces of cardboard, egg cartons, straws, pipe cleaners, rulers, small blocks, unifix cubes, connecting bristle blocks, masking tape,
duct tape, yarn, empty tissue boxes, and clothespins. My goal was to provide my students with a variety of materials, so they could test different materials to see which materials worked best in their designs. This allowed me to extend my students’ thinking by asking questions like, "What made you choose these materials in your design," "What do you think would have happened if you used __ (insert material name) __ to build your bridge? Do you think that would work? Why don't you test it?"

I first introduced this investigation through the read aloud Bridges Connect, by Lee Sullivan Hill (1997). I shared this read aloud under the document camera so that students could get a closer look at the pictures of the bridges. This read aloud was perfect, because the first picture featured the Tower Bridge. I researched some fun facts about the bridge and shared them with the class as part of my hook. I chose not to read the entire book, so that I could give them ample time to build their bridges, but assured them that I would read the book in its entirety at dismissal time. The book highlighted the science vocabulary words engineer and engineering; these were the science words that we focused on during this investigation. I referred to students as engineers throughout the investigation.

In the book, it read that engineers are people who "plan bridges," but I knew that engineers do much more than just planning bridges. In fact, there are many different types of engineers, and engineers are scientists that help to solve problems by planning and creating new things, which I had explained to them after the read aloud.

I presented the problem to students by saying, “So today, you are all going to be engineers because you all have a problem. In pairs, you will be planning and creating a bridge with your partner that crosses from one piece of land to the other. The backs of our red chairs are
going to be the pieces of land. You will use the materials that I have laid out here for you to use to help build your bridge.” Next, I shared the “rules” for bridge building:

1. You MUST use at least three different materials.
2. Your pieces of land (chairs) MUST be one floor tile apart.
3. Your bridge must be able to hold the toy car for at least 20 seconds.
4. You will continue to recreate your bridge after you have tested it.

After opening the “Supply Store,” which was made up of a long table with all of the materials laid out on it, I instructed the engineering pairs to get to work! Although I did go over what good collaboration looks like before sending them off into pairs, I was curious to see how students would react to situations where there was disagreement. Most groups were able to collaborate and successfully build their bridges.

As students were talking with one another, my mentor teacher and I were walking around facilitating conversation with Talk Moves. We also were taking pictures of each pair’s bridges so that I could print the pictures and have the students write about their bridge designs and the materials they used during literacy centers the following day. I had students work on their science journal pages during literacy centers because there was simply not enough time for them to successfully build their bridge and document their thinking on paper. I will definitely think twice about using literacy center time for students to work on their science journal pages in the future, because it gave my students more time to complete their thoughts and document their thinking.
Figure 4 Student Bridge Design

Figure 5 Bridges Read Aloud

Source: (Hill, 1997)
# Building Bridges Engineering

**Author:** Brittany Mueller  
**Date created:** 03/20/2016 9:15 AM EDT  
**Date modified:** 04/12/2016 2:38 PM EDT

## BASIC INFORMATION

<table>
<thead>
<tr>
<th>Grade/Level</th>
<th>Kindergarten</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date to be Taught</td>
<td>Wednesday 3/20</td>
</tr>
<tr>
<td>Time Frame</td>
<td>1 class periods. 50 Mins. per class.</td>
</tr>
<tr>
<td>Subject</td>
<td>Language Arts (English), Science, Technology</td>
</tr>
<tr>
<td>Topic</td>
<td>Bridges: Engineering</td>
</tr>
<tr>
<td>Summary</td>
<td>Students will be engaged in a read aloud titled Bridges Connect, by Lee Sullivan Hill. Teacher will point out the Tower Bridge in the book that is featured on the inside cover page to show the integration between bridges in the UK (where we currently are in our trip around the world for our transportation unit). Teacher will share facts about the Tower Bridge and then read part of the book. Students will then be split into pairs an work collaboratively to build a bridge with an assortment of materials. In literacy centers on Thursday and Friday, students will work on science journal pages.</td>
</tr>
</tbody>
</table>

## OUTCOMES/OBJECTIVES AND STANDARDS

### Objectives/Learning Outcomes
- Students will work collaboratively in pairs.  
- Students will design and create a bridge using at least 3 different materials provided.  
- Students will test their bridges to see if their bridge can hold the weight of a toy car.  
- Students will adjust their bridge designs based on the results of their test.

### Standards

#### PA - Pennsylvania Early Learning Standards
**Key Learning Area:** Logical-Mathematical  
**Standard:** Develop and use measurement concepts  
**Indications:** LM 4.1 Demonstrate awareness of measurement attributes (length, volume, weight, area, time and temperature).

#### PA - Pennsylvania Standards for Kindergarten
**Key Learning Area:** Mathematics  
**Standard:** 2.A. Mathematical Reasoning and Connections  
**Context:** B. Identify the use of measurement in everyday situations

**Key Learning Area:** Reading, Writing, Speaking and Listening  
**Standard:** 1.4 Types of Writing  
**Context:** D. Draw or write informational sentences (letters, descriptions, definitions, collections of facts, simple instructions) using illustrations when relevant

**Key Learning Area:** Science and Technology  
**Standard:** 3.2 Inquiry and Design  
**Context:** A. Build an introductory vocabulary of scientific terms  
**Context:** B. Form clear explanations based on observation and participation in common experiments  
**Context:** E. Demonstrating willingness to modify explanations based on experience or observations  
**Context:** I. Test out solutions

**Key Learning Area:** Geography  
**Standard:** 3.1 The Physical Characteristics of Places and Regions  
**Context:** A. Identify physical characteristics of places, noting physical properties (landforms such as swamps, hills, and mountains), bodies of water such as creeks, rivers, ponds, lakes, and human forms such as highways, streets, buildings, bridges

### Prerequisite Skills
- Students will need to know how to negotiate with one another.  
- Students will need to have a sense of measurement in regard to how sturdy their bridge needs to be in order to hold the toy car (concept of weight).  
- Students will need to know how to share materials with other pairs in a kind manner.

## ASSESSMENT OF STUDENT LEARNING

**Assessment Activities/ rubric:** Assessment-
1) Was the student's bridge able to hold the toy car?
2) Did the pair follow directions:
   - 3 or more different materials were used
   - The pair worked together
   - Both chairs are back to back and 1 floor tile apart from each other
3) Student journal pages (done during literacy centers on Thursday, Friday & Monday)

MATERIALS AND TECHNOLOGY

**Student Materials**
- 2 red chairs per pair (borrow 4 red chairs from Courtney)
- Possible bridge materials:
  - Popsicle sticks
  - Toilet paper rolls
  - Pieces of cardboard
  - Egg cartons
  - Straws
  - Pipe cleaners
  - Rulers
  - Small blocks
  - Unifix cubes
  - Connecting rod blocks
  - Masking tape
  - Duct tape
  - Yarn
  - Clothespins

**Teacher Materials**
- Poster paper - Marker
- Book: Bridges Connect, by Lee Sullivan Hill
- Camera to take pictures of each pair's bridge

**Use of Technology (where appropriate)**

LESSON SEQUENCE AND PROCEDURES

**Introduction (Hook)**
"Can someone raise their quiet hand and remind the class where we are in our trip around the world." (anticipated response: the United Kingdom) "Yes! and can you name the 4 countries that make up the UK? You can ask a friend for help if you need." (anticipated response: England, Scotland, Wales, Northern Ireland). "Awesome work.

So today I have a book about bridges to share with you all, and in this book there are some pictures of famous bridges around the world. Unfortunately I do not have time to read this whole book right now because I want us to get to our fun science project, but I can read the whole book after gym. But for now, I am going to just read parts of it!

**Sequence of Instruction (Step 1, Step 2...)**

**Step 1:** Read title of the book and open up to first page: "This bridge right here is actually a very famous bridge located in London, England which is in the UK. If you remember what the name of this bridge is, raise your quiet hand." (anticipated response: the Tower Bridge. No! This bridge was built in the late 1890's so it is very old. This bridge floats over the Thames River. Also, the middle of this bridge (point) can be lifted to let big ships pass. When people visit London this is a popular place to visit."

**Step 2:** Read rest of book. (When you hear the word "engineer" in the book stop and say "Hmmm... Keep that word in your head. Engineer. Repeat the sentence.

**Step 3:** "So while I was reading, I asked you to keep the word engineer in your brain. In the book it said that engineers are people who "plan bridges." But engineers do much more than just planning bridges. In fact, there are many different types of engineers, and engineers are scientists that help to solve problems by planning and creating new things. So today, you are all going to be engineers because you all have a problem. In pairs (group of two) you will be planning and creating a bridge with your partner that crosses from one piece of land to the other. The backs of our red chairs are going to be the pieces of land. You will use the materials that I have laid out here for you to use, to help build your bridge. But there are a few rules:"

- You MUST use at least 3 different materials (examples)
- Your two pieces of land MUST be 1 floor tile apart.
- Your bridge must be able to hold the car for at least 20 seconds.
- You will continue to recreate your bridge after testing."
Co-teaching in Science

In the implementation process, I was fortunate to have colleagues both in and out of my building to help support my students in learning and engaging in science investigations. In the process, I found it extremely helpful to work with my science methods instructor to plan and implement lessons. Additionally, I co-taught a lesson with another intern in my building. I thought it would be great for her to co-teach with me on a particular air and aviation investigation because I knew that her 3rd grade class was focusing on the same unit. Although we did not go as in-depth into the science content as 3rd grade did, it was nice for my students to see
that they were learning information that they are going to encounter later on in elementary school.

It also was nice to have the extra support in the classroom. When students broke off into small groups, it was ideal to have an adult monitor and facilitate discussion between the children at each table. Given that I have 25 students in my class, we often had four tables with about 6 students at each. My mentor teacher and I would take a table and often my science methods instructor would come in to facilitate a table, as well as my Professional Development Associate, also known as my student teaching supervisor. Besides helping to facilitate children in discussion at tables, parent volunteers also came in to assist children with Kid Writing in their science journals. The adults in the classroom went around helping students write what they meant to say underneath their writing if it was spelled incorrectly, just like Writer’s Workshop, so that I could review their journals knowing what they were thinking.
Conclusion: Lessons Learned and Recommendations

Recall that I set out to find ways to integrate science instruction in a way that made it meaningful to my kindergarten students. I worked to strengthen the connection between science and literacy through the use of integrated science investigations, science talks, read alouds, and student science journals. Through research and experience, I have learned that young children are curious and capable of learning science. I have also learned that teachers can find effective ways to integrate science and literacy in their own classrooms. After implementing a series of ten weekly science investigations that exhibit a strong connection to literacy, I have learned many things that have informed my future teaching. Making my work public allows me to share what I have learned with other educators.

The first lesson that I learned was that in order for students to produce quality science journal entries, they need to be given a sufficient amount of time and support to document their thinking and experiences. The fifteen-minute time slot that I was often able to give my students after an investigation was unfortunately not enough. I consistently noticed that the majority of my students were not able to complete their thoughts on paper, even though they were able to discuss them aloud. Along these lines, Campbell and Fulton (2013) recommended giving students about 45 minutes to write in their journals, based off the sample lesson plans they provide.

I found that the science journals my students completed during literacy centers had significantly more writing than the ones completed during science instruction. This was found in my Building Bridges Engineering investigation. I liked the fact that students were working on
their journals during literacy time because it showed them that science and literacy (writing) are so closely connected. I also found that most students were actually able to finish their journal entries during our literacy center time slot, which lasts about 30 minutes. Therefore, my recommendation to other educators is to provide a dedicated time to science investigations and science talks, and intentionally integrate writing about science observations and explanations during a specified writing time.

Likewise, I have learned that structuring science journals in a way that gives students freedom in what they want to draw and/or write about after an investigation helps gauge whether or not a topic needs to be revisited. For example, in my first investigation I noticed that some of my students were confused about the precipitation process based on their science journal responses. From this information, I knew that the topic was worth revisiting the following week. Campbell and Fulton (2003) stress that, “It is the responsibility of the teacher to determine what is appropriate for the students to record” (p. 6). Being that my students were not familiar with writing about science before coming to kindergarten, it was important to have reasonable expectations for my students. Therefore, my recommendation to fellow educators is to allow your students to write freely about their science experiences after an investigation. This will not only increase student motivation to write/draw, but can also help inform your future instruction.

Furthermore, I have learned that providing my students with read alouds can help deepen their understanding of a topic as well as introduce or reinforce new science vocabulary terms in an investigation. The read alouds that I have chosen for my students purposefully contain the science vocabulary words I plan to focus on during particular investigations. Pappas’ study (2001) proved that exposing young learners to informational texts that relate to a given topic can help enhance their scientific vocabulary and ability to view informational texts as tools for
learning. Read alouds also provide students with additional information that may not be covered during an investigation. For these reasons, my recommendation to other educators is to consider utilizing read alouds either before, during or after an investigation. Read alouds will ultimately provide your students with another opportunity to see literacy during science instruction, while simultaneously expanding their scientific knowledge and vocabulary.

In addition, I have learned that providing students with visuals, and/or allowing them to contribute to building visuals that are represented around the classroom can help foster student discussion about a topic and meaning making. Even after instruction. Zembal-Saul (2013) reports that visual representations can serve as “visual reminders” (p. 81) of learning experiences. The model cloud in our classroom, labeled precipitation, still continues to foster discussion among my students on a regular basis. As previously mentioned, this can be attributed to the schema theory. Science investigations provide rich and tangible interactions with phenomena about which students can make sense and to which they can connect terminology. Visual representations document these connections and serve as developing models for thinking about new questions and learning associated with phenomena. They are tools for both literacy instruction and science learning. Thus, my recommendation to other educators is to consider engaging students in crafting representations of their science learning that can “live on” in the classroom as part of literacy instruction.

Finally, I learned that it is essential to start small and utilize your resources well. Taking on too much at once can feel overwhelming, but being aware that there are resources that can alleviate some of the pressure can be helpful. I have utilized my colleagues, online sources, past course instructors, and parents of my students. All of these resources can be helpful in both the planning and instruction process. Zembal-Saul (2013) supports this when she states “... it is
important to seek out other colleagues for support, either a teaching partner or professional learning community” (p. 147). I have found that having this adult support during instruction can help facilitate conversation between students, and ultimately help keep students on task. Therefore, my recommendation to other educators is not to “go it alone.” Working together to integrate science and literacy provides the support and encouragement necessary to take on new approaches that have potential for supporting students’ learning, curiosity, and interest in science.

As I continue to integrate inquiry-based science instruction in my classroom, I plan to keep looking for ways that I can increase opportunities for literacy connections through investigations. I have currently been able to implement science in my classroom once a week. My goal going forward is to move towards integrating science in my classroom through a series of thematic units that last an extended period of time, and incorporate literacy centers that are focused on the particular science phenomenon.
Appendix A - Investigation 1: Rain Cloud in a Jar

In January, my class was learning about seasons and weather. I thought it would be appropriate to engage students in an investigation on clouds and precipitation being that we had been experiencing snow, hail and rain in Aviary during this time. During our first investigation, I started out with the simple question, “Where does rain come from?” After a short discussion and addressing the simple explanation that rain falls from the sky, I peeked my students’ curiosity with the question, “So if rain falls from the clouds, why do I see clouds in the sky right now and there is no rain coming out of them?” I jotted down all of my students’ initial ideas about the phenomenon in a whole-group discussion. I facilitated this discussion with a series of teacher talk moves (see Table 2).

After this discussion, students were split into 4 groups and took part in a demonstration that gave students a visual of the rainfall process. Through the intentional use of talk moves in a small group setting students were able to make the claim that as tiny water droplets come together forming clouds. The clouds get heavier with liquid water that eventually falls to the earth as rain or other forms of precipitation.

I then provided my students with a blank piece of paper. The instructions were simple. “On this piece of paper you will write what you learned. You can show that by writing, by drawing, or you can do both like in Writer’s Workshop. I would like you to really think about your drawings and make them realistic (vocabulary that we use during Writer’s Workshop).” For the first two investigations, I found that giving students an initial opportunity to share what they were going to draw or write about in their journals gave other students ideas on which to build.

Unfortunately, many students were not able to finish the writing task, and were complaining of not having enough time. I brought all students to the rug and chose two journal
pages to share under the document camera that showed writing, drawings and some labeling. I pointed out to students that the scientists that wrote the journal pages used words and phrases like “cloud,” “heavier,” “water droplets,” “I saw,” and “I think,” in hopes that it would encourage them to use that type of language in their future journal entries.

I chose to end my instruction with a read aloud featured in Figure 6 because I felt that the content of the book helped to extend the concepts that students learned in the investigation. I asked the students to give me a thumbs up if they heard something they learned in the investigation in the book that I was reading. After every couple of pages, students were giving me thumbs up left and right. This was an informal form of assessment, and also helped me gauge whether or not I should revisit the content or proceed with new instruction.

Figure 6 Cloud Read Aloud
# Rain Cloud in a Jar

**Author:** Shirley Master  
**Date created:** 01/13/2005 12:08 PM EDT; **Date modified:** 04/13/2010 8:48 PM EDT

## Basic Information

<table>
<thead>
<tr>
<th>Grade/Level</th>
<th>Kindergarten</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date to be Taught</td>
<td>Friday, Jan 15th</td>
</tr>
<tr>
<td>Time Frame</td>
<td>1 class periods. 50 Min. per Class.</td>
</tr>
<tr>
<td>Subject</td>
<td>Science</td>
</tr>
<tr>
<td>Topic</td>
<td>Clouds</td>
</tr>
<tr>
<td>Summary</td>
<td>Students will investigate the question: When does rain fall from the clouds? Students will make predictions in a whole group setting and then break off into groups to take turns investigating their rain cloud in a jar with a teacher. Students will then be asked to share out what they are thinking and document their thinking in their science journals. What students learned will be validated through a book called Shaped in the Sky, by Joseph A. Sherman.</td>
</tr>
</tbody>
</table>

## Outcomes/Objectives and Standards

**Objectives/Learning Outcomes**

Students will know that rain comes from clouds.

Students will know that clouds are a collection of very tiny water droplets or ice crystals that float together in the air.

Students will know that when water droplets and ice crystals continue to collect in a cloud, they get heavier and heavier. When they get too heavy to float in the air, the water droplets will fall as rain.

**Standards**


**Subject Area:** Science and Technology and Engineering Education  
**Standard Area:** 3.3: Earth and Space Sciences

**Organizing Category:** 3.3.A: Earth Structure, Processes and Cycles  
**Grade Level:** K

**Standard:**

3.3.K.4: Identify sources of water for human consumption and use.  
**Standard:**

3.3.K.5: Record daily weather conditions using simple charts and graphs. Identify seasonal changes in the environment. Distinguish between types of precipitation.

## Prerequisite Skills

- Students will know what a cloud behaves like some information to share for the introductory brainstorming activity.
- Students will know what rain, snow are.

## Assessment of Student Learning

**Assessment Activities/Rubric**

Science Journal Entries (Students will receive a science investigation sheet where they will be asked to sketch a picture of what they've learned and finish the sentence starter "Today I learned...")

Informal Observations - in science talks (whole-group & small group)

Information from the book at the end - do I see a lot of students giving me a thumbs up when they here a something that they knew? (Closure Activity)

## Materials and Technology

### Student Materials

- Macor Jar
- Water
- Shaving Cream
- Detergent
- Food coloring (Blue)
- Blank sheet of paper
- Colored pencils

### Teacher Materials

- Lesson Plan
- Prepared student materials
Over-sized notepad to document student predictions
Student science journals
Paper to hand out

Use of Technology (where appropriate)
- Materials and resources:
  Document camera — if time allows

LESSON SEQUENCE AND PROCEDURES

Introduction (Hook)
Hold up 3 different pictures of clouds and ask students what they are. (Answer: they are all clouds)
They come in all different shapes and sizes.
“What do we know about clouds?”
- Record ideas (hopefully a student will bring up that rain falls from clouds)
Then tell students that clouds are made of heavy tiny ice crystals or water droplets that are so small they can float in the air together.

Sequence of Instruction (Steps 1, 2, 3...)
Step 1 (7 minutes): Whole group on carpet. Hook: “So I heard someone mention that rain falls from clouds, but I see clouds outside right now and I don’t see rain falling down. Why is that?” — student responses
“Hmm. I am hearing lots of great thinking. Let’s investigate this.”
Step 2 (3 minutes): Explain activity
“I will split you all into 3 groups. A teacher will be at each table and will be THE ONLY ONE who will touch the materials. At each table we are going to pretend that the shaving cream is our cloud, and what are clouds made of again??” (student responses: Very tiny water droplets or ice crystals that float in the sky). GREAT. Now at your table you will find a dropper and food coloring. We are going to pretend that our food coloring is the rain! I want you all to be paying close attention to how many drops it takes for the rain to fall and reasons for why the rain might be falling.”
Can anyone repeat for me what we are paying close attention to.
At this table I will have.... Call students to table
Step 3 (5 minutes): Adult at table will have a brownie jar filled 1/4 with water and 1/4 filled with shaving cream to simulate a cloud. Adult will have a dropper with food dye. Adult will continuously drip droplets of food coloring onto the cloud. Students can count how many drops it takes for the cloud to start raining. They will notice that it doesn’t start raining right away. It takes time. Why is that.
Step 4 (5 minutes): Quick discussion on carpet. “So let’s get back to our question: We were wondering why clouds don’t make rain all the time. After this activity, can anyone take a guess? What did you notice about your clouds?”
Step 5 (20 minutes): Write in science journals about what they learned and a picture. Adults in room will circulate and help kids write.
Step 6 (5 minutes): Share under document camera if time allows

Closure/Wrap Up
Now you are all cloud experts. I am going to read you a book called Shapes in the Sky, by Josephine Sherman.
- As I read, I would like you to give me a thumbs up if you hear something in the story that you learned today from our investigation.

Independent Practice (where appropriate)
N/A

Differentiated Instruction
When helping children with kid writing in their science journals...
- Certain students will need an adult to write their thoughts down and they can trace over the highlighted writing.
- Some students can write on their own, but will need their words underlined.
Appendix B - Investigation 2: Clouds and Precipitation Revisited

Still on the thematic unit of seasons and weather, I decided to engage students in a science-based activity that created a visual that would be displayed in our classroom. The purpose of this activity was to build my students’ science vocabulary knowledge and reinforce the word “precipitation.” Our students focused on three types of precipitation: rain, snow and hail.

Since the activity connected to what the students learned about clouds the week before, I wanted to reinforce the claim that they had previously made. I did this by giving my students a visual demonstration of dripping water on a paper towel. This visual actually shows the kids how the paper towel gets heavy from the water as it concaves in a downward direction, and eventually, after many drops of water, the paper towel starts to drip, or in our case “precipitate.” This visual seemed to really make sense to students.

After the quick demonstration, I showed my students a 3-minute Sid the Science Kid video clip. This reinforced our claim and used the word precipitation. As we engaged in a conversation about precipitation, my mentor teacher began to hang the cloud that I had made (See Figure 7). In the activity, I had each child rotate in three stations as they made a visual representation of each form of precipitation.

The next school day, I attached all of the precipitation visual that the students had made to the cloud. I then labeled the cloud with the word Precipitation. I was curious to see how this visual representation would affect students use of the word. Now in our classroom, when it starts to rain, snow or hail outside, students know to call it precipitation. Being that many of my kindergarten students get excited when it is raining, it is likely that they will call out when they notice the change in weather. When this happens, I ask the student, “What is happening
outside?” and point to our cloud. The student will then look and respond that it is precipitating outside.

Figure 7 Rain Cloud Visual
Clouds and Precipitation Revisited

Grade/Level: Kindergarten
Date to be Taught: Friday 1/22
Time Frame: 1 class periods. 30 Mins. per class.
Subject: Science
Topic: Clouds & Precipitation
Summary: We will open by revisiting a couple of science journal entries from last week under the document camera (opening activity). The teacher will then give an example of why rain falls with a paper towel and a water dropper. After, students will watch a short video on the water cycle. After this we will have a short discussion and then children will make rain drops, hail, and snowflakes that will hang from our big rain cloud in the classroom as a model of precipitation.

OUTCOMES/OBJECTIVES AND STANDARDS
Objectives/Learning Outcomes:
Students will know that precipitation is another word for rain, snow, and hail.
Students will know that precipitation occurs when the cloud becomes too heavy.

Standards:
Subject Area: Science and Technology and Engineering Education
Standard Area: 3.3: Earth and Space Sciences
Organizing Category: 3.3.A: Earth Structure, Processes and Cycles
Grade Level: K
Standard: 3.3.K.45: Record daily weather conditions using simple charts and graphs. Identify seasonal changes in the environment. Discuss changes between types of precipitation.

PA- Pennsylvania Early Learning Standards
Key Learning Area: Science
Standard: Acquire knowledge about the earth and space
Indicator: SC 4.1 Understand changes in the environment, including weather and seasonal changes

Prerequisite Skills:
Students will need to know that rain, snow, and hail come from clouds. (Learned last week)

ASSESSMENT OF STUDENT LEARNING
Assessment Activities/Rubric: Informal observations through discussion and participation.

MATERIALS AND TECHNOLOGY
Student Materials:
- Rain drop, hail and snowflake cut-outs
- Clear wrap for hail
- Blue water color paint
- Paint brushes & water cups
- White crayons
- Silver glitter
- Pencil (to write name)

Teacher Materials:
- Student science journals (revist from last week)
- Model of cloud (will hang from ceiling)
- Clear string (to hang cloud and rain drops from ceiling)
- Vocabulary words to label the model (cloud, precipitation)
- Paper towel and water dropper (simulation)
Use of Technology (where appropriate)

- Materials and resources:
  - Document Camera: beginning sharing activity

LESSON SEQUENCE AND PROCEDURES

Introduction (Hook)
Can anyone raise their quiet hand and remind the class about our science investigation last week? I know it was a long time ago. (Student response: clouds, rain, snow, and hail and why it rains).

Sequence of Instruction (Step 1, Step 2...)

Step 1: Doc Camera – “To jog your memories, I am going to share some student work from last week under our document camera.” (5 mins)

Step 2: Let’s talk about what you know. I have a better idea how rain looks. I’m going to show you another quick example. (Lisa holds paper towel in hands while I drop water from a dropper. Eventually the water will build up so that the paper towel cannot hold it and then water will start to drip from it.) We know that clouds are made of tiny water droplets. But for this example our cloud is a paper towel (hold up paper towel) and this water is our rain. When I add water to this paper towel it does not go right through. As I am adding more and more water what are you noticing? (Ask for student responses). Eventually water will start to drip from paper towel and we can talk about rain. (5 mins)

Step 3: I have a short video that I would like to share with you all. (Play the video) Sometimes the kid is going to talk to you about clouds and then we will talk about what we know about clouds. Video clip: “https://www.youtube.com/watch?v=5oXiF3hEhG5” (talks about how clouds are made up of tiny water droplets and introduces the vocabulary word precipitation) (5 mins)

Step 4: Set the Science kid question. “So we know that clouds are made of tiny water droplets and when clouds get too heavy they can rain, snow or hail. But I have a special big science word that I want to share with you. Now this is a second-grade word, are you ready? (Show them the precipitation word strip) This word is precipitation. Precipitation is a fancy word for rain, snow and hail. What is precipitation? (Rain, snow and hail).” I know you all noticed our big heavy clouds in the room. I think that it is getting pretty heavy. In fact I think it is going to precipitate soon. (5 mins)

Step 5: Today we are going to make our own precipitation! Our cloud is going to have rain, snow and hail. On the kidney table we have rain drops, hail squares and snowflakes that you may decorate. If you would like glitter on your precipitation, you may ask a teacher to help you. You may take two different types of precipitation, so I can take a snowflake and hail, or I can take a rain drop and hail, but I cannot take all 3 to decorate. Only 2. Once you finish your two pieces of precipitation, you can put your precipitation over by the drying rack and grab a worksheet from the kidney table. (2 minutes)

Step 6: Kids can make their own precipitation at their tables. (6 minutes)

Closure/Wrap Up
Maybe when you all come back to school on Monday our cloud will be precipitating! (Big cloud that hangs from our ceiling)

Independent Practice (where appropriate)
N/A

Differentiated Instruction
Individualized attention while walking around.

Both helping students understand (repeating the word precipitation and what it means). Also testing the knowledge of learners who may find the concept more simple.

Possible Follow-Up Activity
Students who finish early can work on a clouds worksheet. (What’s the weather? with a cloud on it. Students can choose to draw their cloud snowing, raining, or hailing.)
Appendix C - Investigation 3: Sink/Float Center

This investigation really focused on students making predictions and observations based on the data that they were collecting. In every science investigation that I implemented, I started out with my students making predictions. I find that predictions, when followed-up with the Talk Move, “Why do you think that,” can be extremely valuable when trying to assess students’ initial ideas and thinking.

The investigation connected nicely with our transportation unit, Around the World. That particular week, our class was learning about Italy and boats. We spoke about how boats are a popular form of transportation in Italy and even went on a virtual gondola ride through the Grand Canal. My goal was to build the connection between boats and the concept of sinking and floating objects. This short investigation engaged my students in the scientific practice of data collection, with a focus on predictions, observations, and results. This investigation also was helpful in extending my students’ thinking by asking them simple questions after they had tested all of their materials like, “If you had the chance to build a boat, what material would you use?” These questions required students to look back at their data recording sheet and see what materials sank and which ones floated.
Sink/Float Center

Grade/Level: Kindergarten
Date to be Taught: Tuesday 2/2 & Wednesday 2/3
Time Frame: 2 class periods. 15 Mins. per class.
Subject: Science

Topic: buoyancy

Summary: Students will predict which items will either sink or float when placed in water on their worksheets. The teacher will then drop the items in the water and children will record the result on their worksheet. Students will then be engaged in a brief talk about what they noticed.

OUTCOMES/OBJECTIVES AND STANDARDS

Objectives/Learning Outcomes

Standards
PA: Pennsylvania Early Learning Standards
Key Learning Area: Science
Standard 4: Acquire knowledge about the physical properties of objects
Indicator 2: Describe, compare and categorize objects, based on their properties
Example: The child will use a variety of classroom tools such as pencils, scissors and tape recorders

Prerequisite Skills
Students should know that a prediction is a guess. Should know the terms: sink and float.

ASSESSMENT OF STUDENT LEARNING

Assessment Activities/Rubric: Informal observation through discussion. Recording on sink/float worksheet.

MATERIALS AND TECHNOLOGY

Student Materials: Sink/Float worksheet
Regular Pencil

Teacher Materials: Bowl of water
Penny
Straw
Cotton Ball
Pencil
Straw
Craft Stick
Rock
Paper Clip

Use of Technology (where applicable):

LESSON SEQUENCE AND PROCEDURES

Introduction (Hook): Today, we are going to do a mini investigation with water! We are going to predict which materials are going to sink and which ones will float when they are placed in water. Can someone remind me what a prediction it? (Answer: A prediction is what we think is going to happen. It is a guess. It doesn’t have to be correct.) (1 minute)
| Sequence of Instruction (Step 1, Step 2...) | Step 1: Pass out worksheet and ask students to write their names at the top with a regular pencil.  
Step 2: Talk through each object and have students predict on their sheet whether they think the objects will sink or float. If there is controversy over an item, ask students why they predicted what they predicted. (6 minutes)  
Step 3: Test each item and have students record the results on their sheet. Student will either write sink or float on their worksheet in the results column. (6 minutes)  
Step 4: If time allows, have students talk about what surprised them. Also talk about the properties of the materials and what happened (Ex. All items made of metal sank, why is that?) (2 minutes) |
| Closure/Wrap Up | Center switch. Clap hands after 15 minutes. Put materials away, put worksheets in the center of the table, push chairs in and meet on the rug. |
| Independent Practice (where appropriate) | N/A |
| Differentiated Instruction | Extend discussion for groups that seem to grasp the concept easily. (Ask a lot of "Why do you think that?" questions.) |
Our next investigation tied in nicely with our transportation unit, Around the World, and the math measurement unit. During the week that we conducted this investigation, our class was learning about airplanes as a form of transportation. Our students had even experienced a flight simulation at the very beginning of their “trip around the world,” which took off prior to the investigation. Also at this time, students were learning about length, height and weight as types of measurement. This helped me formulate a hook that allowed me to assess my students’ prior knowledge of the different forms transportation that we spoke about, while also getting them to see the integration between units.

I was able to co-teach this lesson with a fellow intern in my building who was also in PDS. We decided that co-teaching would be beneficial for this particular lesson because her 3rd grade placement classroom was learning about air and aviation as well. Since she had experience teaching the 3rd graders about the principles of flight, I had asked if she would like to plan and co-teach a lesson with me for my kindergartners. I thought it would be a meaningful experience for the both of us to see how the content can be similar yet the focus adapted to fit the needs of the grade level and students.

Our goal was to focus on gravity and weight. First, we introduced students to four different paper airplanes. We showed them that airplane #1 had one penny taped to it, airplane #2 four had pennies taped to it, airplane #3 six had pennies taped to it, and airplane #4 had ten pennies taped to it. We then had students use post-it notes to make predictions of which plane they thought would fly the farthest (See Figure 8). After students made their predictions, we introduced the focus words, gravity and weight, through the read aloud, How People Learned to Fly, by Fran Hodgkins (2007) (See Figure 9).
After the read aloud, we gave students the chance to change their predictions on the chart. If the student chose to change their prediction, we would simply ask them, “Why?” This gave students the opportunity to share their thinking and use the knowledge that they acquired from the read aloud in their investigation.

Next, we took our class into the hallway and had students line up on both sides of the walls, like a airplane runway. The intern that I was co-teaching with flew the first two airplanes and I flew the second two. It turned out that airplane #1 with one penny flew the farthest. We then went back into the classroom to discuss the results of the investigation. We prompted students with talk moves, such as “What did you notice,” “Why do you think that,” “Show me a thumbs up if you agree with (student name).” Doing this gave students a chance to debrief about what they saw, share their explanations/thinking, listen to what their peers had to say, and politely agree and/or disagree with one another.

Lastly, I gave students a blank sheet of paper for them to document their thinking in their science journals. The instructions were simple, “You can draw and label a picture of what we did, you can write about what you learned or what we did, or you can do both!” I do not give students specific instructions because I use student science journal pages as a form of assessment. Giving students the freedom to structure their pages how they want allows them to be creative, but also shows me what they really took away from the investigation.

I noticed, again, that a majority of students did not get to finish their pages, but I was able to show 3 student journals under the document camera. These pages used words like “airplane,” “weight,” “heaviest,” “lightest,” “farthest,” and “gravity.” These journal pages then get filed with their other science journal pages, so that they can get laminated and bound to be taken home at the end of the school year. The following day, I was able to hang the airplanes in our classroom
around our precipitation cloud (See Figure 10). The students absolutely loved this when they saw it. Unfortunately, I do not hear my students talking regularly about gravity as I do with the word precipitation. This could definitely be because the word gravity does not regularly come up in conversation where as the weather is always changing.

Figure 8 Air & Aviation Predictions

Figure 9 Air & Aviation Read Aloud

Source: (Hodgkins, 2007)
Figure 10 Air & Aviation Gravity Visual
Air and Aviation

Author: Brittny Mulher
Date created: 01/15/2016 11:37 AM EST; Date modified: 04/11/2016 9:46 PM EST

BASIC INFORMATION

Grade/Level: Kindergarten
Date to be Taught: Wednesday 2/3, 12:30-1:45
Time Frame: 1 class periods, 1.25 Hrs. per class.
Subject: Science
Topic: Air and Aviation

Summary: Students will then be introduced to 4 different paper airplane models. Students will make predictions about which plane they think is going to fly the farthest on a large chart (post-it notes). Students will be engaged in a read aloud, *How People Learned to Fly*. Teachers will then fly the planes and see if the student's predictions were correct. After a short discussion, students will have the opportunity to draw and write down what they learned in their science journals.

OUTCOMES/OBJECTIVES AND STANDARDS

Objectives/Learning Outcomes:
- Students will be able to make a prediction.
- Students will be able to justify their thinking with evidence.
- Students will know that that gravity and weight play a factor when flying paper airplanes.

Standards:
- PA- Pennsylvania Early Learning Standards
  - Key Learning Area: Science
    - Standard: Demonstrates understanding of the process of scientific inquiry
    - Indicator: SC 1.1 Show curiosity by asking questions and seeking information
    - Indicator: SC 1.4 Make and verify predictions
    - Indicator: SC 1.5 Compare, contrast and classify objects and data
    - Indicator: SC 1.6 Use language that shows understanding of scientific principles
    - Indicator: SC 1.7 Participate in scientific investigations

Prerequisite Skills: Students will need to know what it means to observe (using their eyes closely).

ASSESSMENT OF STUDENT LEARNING

Assessment Activities/Rubric:
- Informal observation through discussion
- Documented student work through student science journal pages (drawings, writing, both)
- Anecdotal notes

MATERIALS AND TECHNOLOGY

Student Materials:
- Post-it Note (to make prediction)
- Blank Piece of paper - science journal
- Regular pencils
- Colored pencils

Teacher Materials:
- 4 paper airplane models (1 penny, 4 pennies, 6 pennies, 10 pennies)
- Large piece of paper to record student predictions
- *Read Aloud: How People Learned to Fly*, by Frank Hodgkins

Use of Technology (where appropriate):
- Materials and resources:
  - Document camera to share student science journal entries as a closure activity.

LESSON SEQUENCE AND PROCEDURES

Introduction (Hook): Miss S and I have been talking, and we know that you have been learning a lot about the different types
of transportation. Raise your quiet hand if you you remember one type of transportation that we've talked about.”  

(Student responses- access prior knowledge) “Knowing that you all have been on a flight to Venice, we thought it would be fun to do an investigation using paper airplanes!” (1 minute)

<table>
<thead>
<tr>
<th>Sequence of Instruction (Step 1, Step 2…)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1:</strong> Introduce 4 paper airplanes. (Brittany &amp; Charlotte) (2 minutes)</td>
</tr>
<tr>
<td>Airplane 1- 1 penny</td>
</tr>
<tr>
<td>Airplane 2- 4 pennies</td>
</tr>
<tr>
<td>Airplane 3- 6 pennies</td>
</tr>
<tr>
<td>Airplane 4- 10 pennies</td>
</tr>
<tr>
<td><strong>Step 2:</strong> Now that you have seen all of our planes, we have a question for you all. We would like you to predict which plane will fly the farthest. Can someone remind me what a prediction is? (Answer- A prediction is a guess)</td>
</tr>
<tr>
<td>Hand out post-it notes and regular pencils to children on the rug. Ask them to write their name on it. Then have each child individually come up to the chart and stick their post-it note on the chart of which plane they think will fly the farthest. (Brittany) (10 minutes)</td>
</tr>
<tr>
<td><strong>Step 3:</strong> Read book: How People Learned to Fly. (Charlotte) (15 minutes)</td>
</tr>
<tr>
<td>Words to focus on: gravity &amp; weight</td>
</tr>
<tr>
<td><strong>Step 4:</strong> Ask students after the book, if any of them would like to change their predictions. If students would like to change their predictions after the reading, ask them why. (Brittany) (5 minutes)</td>
</tr>
<tr>
<td><strong>Step 5:</strong> Fly the 4 model planes one at a time. (Brittany &amp; Charlotte) (2 minutes)</td>
</tr>
<tr>
<td><strong>Step 6:</strong> Discuss results with the class. “What did you notice?” “Why do you think that?” “Show me a thumbs up if you agree with ______.” (Both) (5 minutes)</td>
</tr>
<tr>
<td><strong>Step 7:</strong> Give students a blank sheet of paper to write in their science journals. Tell them that they can draw a picture of what we did, they can use words to show what they learned, or they can use both. (25 minutes)</td>
</tr>
<tr>
<td><strong>Step 8:</strong> Document camera (if time allows) (10 minutes)</td>
</tr>
</tbody>
</table>

**Closure/Wrap Up**

Document Camera: Go through and share what each student wrote in their science journals (This should be quick-3 minutes)

**Independent Practice (where appropriate)**

N/A

**Differentiated Instruction**

While students are writing their science journal page, teachers will go around to help students who seem to be struggling.

Some students will need grown up writing.

Some students will need to be prompted to begin writing or drawing a picture.

Some students will need help forming letters. In which case, adults will write what they want to say in highlighter so that they can trace over it.

**Possible Follow-Up Activity**

Students can work in pairs with Charlotte’s 3rd grade class to design their own paper airplanes.
Appendix E - Investigation 5: Valentine’s Liquid Reactions

This investigation required students to make predictions and observations. We really focused on the science vocabulary word, reaction. Since this investigation was conducted close to Valentine’s Day, I felt that it was appropriate and fun for students to use candy hearts to spark a reaction in different liquids (soda, vinegar, water, and rubbing alcohol). I started out by assessing their prior knowledge.

Unfortunately, we only had two adults in the classroom that day to facilitate the investigation at tables. Therefore, we only had two tables with about 10 children surrounding each one. In this investigation students learned that when candy hearts (i.e., sugar) are placed in the different liquids, there is a reaction shortly after, as signified by the production of gas bubbles. Each student was asked to make a prediction about the reaction they were going to see when the candy hearts were dropped in each liquid. Then each student observed the adult at their table drop the candy hearts in each bottle of liquid, which they were very excited about. After closely observing each reaction, students were invited to share and explain what they noticed and how their prediction had changed.

If I were to teach the lesson again, I would have more adults in the room running centers. Unfortunately, we were only able to have two tables to show the reactions to kids. I would at least have two other tables (4 in total). Since 10 children were at each small table, it was tough for all of them to see the reactions without getting in the way of one another. Due to the fact that students were so excited about what they were seeing, they were bickering over who was leaning too close to the bottle and as well as who could see the reaction and who couldn’t. I think smaller groups could have cut down on time and could have offered the kids a better environment to share their thinking.
After the short investigation, I had students write and/or draw on a blank sheet of paper that was put into their science journal file. For this particular lesson, I was only able to give them about six minutes, which is not nearly as much time as I planned to give them, because they had to go to gym class. Yet again, I still received student comments like, "How come you never give us enough time to finish our science writing!"

In order to give students more time to work on their science journal pages, I could have limited the small group predictions to only three students sharing per liquid. It took up a lot of time and I think it would have been more valuable to give the kids more time to document their thoughts in their science journal pages.
# Valentine's Liquid Reactions

**Author:** Brittany Mueller  
**Date created:** 02/07/2016 2:36 PM EDT  
**Date modified:** 04/11/2016 9:48 PM EDT

## BASIC INFORMATION

- **Grade/Level:** Kindergarten  
- **Date to be Taught:** Wednesday 2/10  
- **Time Frame:** 1 class periods, 40 Min. per class.  
- **Subject:** Science  
- **Topic:** Candy Heart Reactions

**Summary:** Students will predict and observe what will happen to candy hearts as they are dropped into 4 different liquids (water, sprite, rubbing alcohol, vinegar). Students will then test the candy hearts and observe closely what happens to the candy hearts over time. Students will then be brought to the carpet to discuss what they saw and reflect on what they observed in their science journals.  
https://fun-a-day.com/candy-heart-experiments-valentines-day

## OUTCOMES/OBJECTIVES AND STANDARDS

**Objectives/Learning Outcomes:**  
- Students will understand and know how to make a prediction.  
- Students will be able to observe closely using their eyes.  
- Students will know that different reactions are dependent on the solutions that the candy heart is placed in.

**Standards**  
**PA- Pennsylvania DOE Standards Aligned System - Clear Standards (2010)**  
**Subject Area:** Science and Technology and Engineering Education  
**Standard Area:** 3-5: Physical Science: Chemistry and Physics  
**Organizing Category:** 3.2.A: Chemistry  
**Grade Level:** K  
**Standard:** 3.2.K.5.A: Describe the way matter can change.

**PA- Pennsylvania Early Learning Standards**  
**Key Learning Areas:** Science  
**Standards:** Acquire knowledge about the physical properties of objects  
**Indicators:** SC 3.3 Explore, identify and describe changes that occur over time

**Prerequisite Skills:** Students will need to know how to follow directions.

## ASSESSMENT OF STUDENT LEARNING

- **Assessment Activity/Rubric:** Informal Observation (participation & discussion)  
  - Anecdotal Notes  
  - Science journal responses

## MATERIALS AND TECHNOLOGY

**Student Materials:** Blank piece of paper (science journal page)  
- Regular pencil  
- Colored pencils

**Teacher Materials:** Large sheet of poster paper to document student predictions  
- 12 empty water bottles  
- 3 box of candy hearts  
- (24 ounces of water, vinegar, sprite, rubbing alcohol)

**Use of Technology (where appropriate):**
**LESSON SEQUENCE AND PROCEDURES**

**Introduction (Hook)**

T: "I know I have been hearing a lot of you talking about a special holiday that is coming up. Can anyone raise their quiet hand and tell me what that holiday is called?" Valentine's Day

T: "Yes, Valentine's Day is on February 14th. So since Valentine's day is coming up, we are going to do a fun science experiment using candy hearts. (hold up candy heart box)" (1 minute)

**Sequence of Instruction (Step 1, Step 2...)**

**Step 1:** Introduce the question to kids. "What will happen to the candy hearts when we put them in different liquids?" (1 minute)

**Step 2:** Introduce the 4 different liquids to students in labeled water bottles. Hold them up to the class as they are introduced. Explain that vinegar is used for cooking, and rubbing alcohol is used in many cleaning things like hand sanitizer. (2 minutes)

**Step 3:** Record student predictions on large poster paper. Under each liquid, record what students think might happen. Remind students that a prediction is just a guess at what they think might happen. It doesn't have to be right. (7 minutes)

**Step 4:** Have students separate into 3 different groups. 7/8 students / teacher

Have students gather around table and observe the candy hearts as they are placed in the liquid. Drop 3 candy hearts in each water bottle. Talk about how the candy heart is reacting to the liquid it is put in. Ask students what they are observing with their eyes. (5 minutes)

**Step 5:** Come back to carpet and have a brief discussion about the reactions the children saw. (5 minutes)

**Step 6:** Give students the opportunity to write about the different reactions in their science journals. (15 minutes)

**Closure/Wrap Up**

Sharing student science journal pages under document camera, if time allows. (4 minutes)

**Independent Practice (where applicable)**

N/A

**Differentiated Instruction**

While students are writing their science journal page, teachers will go around to help students who seem to be struggling.

Some students will need grown up writing.

Some students will need to be prompted to begin writing or drawing a picture.

Some students will need help forming letters, in which case, adults will write what they want to say in highlighter so that they can trace over it.

**Possible Follow-Up Activity**

Keep water bottles in the classroom in a place where the kids can make observations at their leisure. Encourage kids to talk about how the candy hearts change over time.
Appendix F - Investigation 6: Mystery Box

I discovered the Mystery Box investigation through my science methods seminar hosted in early February. This PDS science methods seminar was extremely valuable because it challenged me to connect and adapt the investigations that we experienced in seminar, to the grade level of my own classroom.

As I was participating in this particular investigation in seminar, I was thinking that the Mystery Box activity would fit in nicely with our math measurement unit, being that in math we were talking about length, height, width, and weight as forms of measurement.

In this investigation, children were exposed to a small box featured in Figure 12. In a whole group setting, students were asked to make predictions about what could be inside of the box, observing only with their eyes. These beginning predictions were recorded in Figure 11, and served as a great pre-assessment of their measurement and spatial awareness skills.

Once these whole-group predictions were recorded, students were split into teams of 5 or 6. They were given a recording sheet, and a mystery box with an unknown object inside of it. Students were then asked to make a prediction about what is inside the box after being instructed to shake it. At the beginning of the school year, our class spoke about using our five senses. This activity gave them the opportunity to use their sense of hearing. It was nice to be able to connect the language I used with the kids earlier in the year to this lesson.

After the kids were given the opportunity to shake the box and make a prediction, students were then given a plate of 11 objects and an empty box that they used to compare to the real mystery box. As students were testing the objects, I heard them saying things like, “It is definitely not the base 10 block because it is too long to even fit in the box,” and “It isn’t the
marble because the marble is a little heavier than what is inside the mystery box.” It was clear that they were using measurement language without even realizing it.

The recording sheet, featured in Figure 13, acted as their science journal for that week. In the first box students drew pictures of what they thought was in the mystery box without being exposed to the possible materials. They were asked to provide an explanation as to why they chose the object they did. Likewise, in the second box, students were instructed to choose one of the materials on the plate that they tested and thought was in the actual mystery box and why. This recording sheet allowed students to document their thinking throughout the investigation, as opposed to after the investigation was conducted, like they were used to.

I chose not to reveal what was in the mystery boxes because I wanted students to continue to talk about the investigation. I had students begging me to tell them what was in the box. After about four days of constant asking, I promised my class a mini-reveal party at the end of the day the following week. Most students predicted correctly that the object inside of the mystery box was a die, but some of the students who predicted an object other than the die were upset, one student was even in tears. I think that next time I implement this investigation with my students I will not reveal what was actually in the mystery box, because I do not want the emphasis of the investigation to be on being correct. Rather than a competition, the emphasis should be on the modeling process as described in NGSS, which reflects the actual work of scientists.
Figure 11 Mystery Box Predictions

Figure 12 Mystery Box Model
Name: _______________________

**WHAT’S IN THE MYSTERY BOX?**

Draw & write about what you think is in the mystery box before you receive materials and after you receive materials!
Mystery Box

Basic Information

Grade/Level: Kindergarten
Date to be Taught: Thursday 2/167
Time Frame: 1 class periods. 45 Mins. per class.
Subject: Science
Topic: Mystery Box- Senses, measurement

Summary: Students will be placed in groups of 5 or 6. There will be 4 groups. Each member of the group will have their own paper, and each group will have their own box small box that is duct taped closed. Students will go through a set of instructions of what they can do with the box. As they are led through the instructions, they will begin to predict what could possibly be inside of the box.

Outcomes/Objectives and Standards

Objectives/Learning Outcomes:
- Students will be able to explain their predictions with supporting evidence.
- Students will collaboratively work together in small groups.
- Students will use their senses to try and figure out what is actually in the mystery box.

Standards:

PA- Pennsylvania Early Learning Standards
Key Learning Area: Logical-Mathematical
Standard: Develop and use measurement concepts
Indicator: LM 4.1 Demonstrate awareness of measurement attributes (length, volume, weight, area, time and temperature)

PA- Pennsylvania Standards for Kindergarten
Key Learning Area: Mathematics
Standard: 2.3 Measurement and Estimation
Contents: A. Understand the spatial concepts of over, under, beside, in, on, around, on and between, above, top, bottom.
Example: The learner will: Compare the measurement of different classroom objects.

Key Learning Area: Science and Technology
Standard: 3.2 Inquiry and Design
Contents: C. Use the five senses as tools with which to observe, collect information, classify, describe
Contents: E. Demonstrating willingness to modify explanations based on experience or observations
Contents: F. Demonstrate understanding of the process of scientific inquiry by participating in scientific investigations; asking relevant questions; making predictions based on experience or observations

Prerequisite Skills:
- Students will need to know what a prediction is.
- Students will need to know how to listen to and follow instructions.

Assessment of Student Learning

Assessment Activities/Format:
- Informal Observation - (science talks)
- Student Science Journal Page - (worksheet of predictions)
- Video & Pictures of student work and engagement

Materials and Technology

Student Materials:
- Pencils
- Colored Pencils
- 4 Duct Taped Mystery Boxes with Object inside them (1 per group)
- 4 Unduct Taped Boxes w/ die (1 per group)
- 4 tokens of objects (1 per group) (each bowl will have: die, paper clip, pencil, eraser, uniform cube, plastic bear, soft domino, pipe cleaner, marble, rubber band, ponytail ball)
Appendix G - Investigation 8: Worms

Shortly after a mid-March rainfall, our class went outside for recess. My students immediately noticed an abundance of worms on the pavement leading up to the playground area and on the blacktop. Many students in my class seemed to be fascinated by the worms and made
it their duty to save them and put them back in the soil so they wouldn’t get stepped on by children playing. A majority of my students were frantically running around the playground saving these worms, and asking my mentor and I questions about them.

In conversation with my mentor teacher, we decided that it would be compelling to conduct a worm investigation in our classroom using live worms, being that our students already had so many questions about them. I was able to tie this investigation in nicely with our Living and Non-living unit. Students were engaged in the read aloud *Wiggling Worms at Work*, by Wendy Pfeffer (2003), in order to give them some background information about worms, and to hopefully address the many questions that they had about worms (See Figure 14). Then I had students investigate and compare a real earthworm to a gummy worm. I gave my students an observation sheet that asked them to draw a detailed picture of both their earthworm and gummy worm, measure both worms with paperclips (connection to measurement), write about how their worm felt (connection to sense of touch), and asked the student to circle whether if they though both the earthworm and the gummy worms were living or non-living and back-up their claim with evidence (explanation).

I showed the worms underneath the document camera to give students a closer look at what the worms look like. I even had student point out the tiny details about the worms that they were noticing. Students were able to point out things like worms have tiny lines along their bodies, and they also vary in color, some are lighter in color than others. I gave out magnifying glasses for students to use, to get a closer look at their worms at their tables. Students seemed to really enjoy using the magnifying glasses as an observation tool (See Figure 15).

The recording sheets were used as the students’ science journals for that week. I particularly liked the journal page because all students were required to draw a detailed picture
of their worms, while also being required to engage in constructing an explanation as to why they thought the earthworm and gummy worm was living or non-living. Their responses were a great form of assessment.

Figure 14 Worms Read Aloud

Source: (Pfeffer, 2003)

Figure 15 Student Engagement with Worms
Figure 16 Worm Observations

Worm Observations

My Worm felt slimy. - Taro - Enzo
My Worm danced and wriggled around when it crawled off my plate and we put it back on. - Lily
My Worm smelled bad. - Enzo
My Worm had lots of lines. - Natan
My Worm felt like my gummy worm. - Aiko
### Worms

**Author:** Brittany Muster
**Date created:** 02/14/2016 7:39 PM EDT  |  **Date modified:** 04/11/2016 9:54 PM EDT

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#### BASIC INFORMATION

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<td>Time Frame</td>
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<td>Subject</td>
<td>Science</td>
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<tr>
<td>Topic</td>
<td>Living and Non-Living things — Worms</td>
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</table>

**Summary**

Students will be engaged in a read aloud about worms, *Wiggling Worms at Work* by Wendy Pfeffer. After the read aloud students will be shown a real worm under the document camera. While focusing on observations, students will be working independently on a worksheet that compares live worms to gummy worms (each student will have 1 live worm and 1 gummy worm). After filling out their cheat sheet, students will come together as a group for a discussion on the rug concerning their observations.

#### OUTCOMES/OBJECTIVES AND STANDARDS

**Objectives/Learning Outcomes**

- Students will draw their objects with detail.
- Students will label their pictures.
- Students will be able to distinguish between living and non-living things.

**Standards**

**PA - Pennsylvania Early Learning Standards**

**Key Learning Area:** Science

**Standards**

- SC 1.2 Demonstrate understanding of the process of scientific inquiry
  - Indicator: SC 1.3 Use tools and equipment to observe objects
  - Indicator: SC 1.5 Compare, contrast, and classify objects and data
  - Indicator: SC 1.7 Participate in scientific investigations

**PA - Pennsylvania Standards for Kindergarten**

**Key Learning Area:** Science and Technology

**Standards**

- 3.2 Inquiry and Design
  - Content: C. Use the five senses as tools with which to: observe, collect information, classify, describe
  - Content: D. Use observation to develop a descriptive vocabulary based on sensory experiences

- 3.3 Biological Sciences
  - Content: A. Identify the similarities and differences of living things
  - Content: B. Identify the life processes of living things

**Prerequisite Skills**

- Students need to know how to listen to and follow directions.
- Students need to know how to be gentle when handling living things (worms).
- Students need to know how to compare two things (living worm vs. gummy worm).

#### ASSESSMENT OF STUDENT LEARNING

**Assessment Activities/Rubric**

- Worm Worksheet: responses and detailed drawings of worms.
- Student response to *My Worms* prompt at the end of investigation on the carpet.
- Informal observation: participation, answers to questions, ability to follow directions (behavior during investigation).

#### MATERIALS AND TECHNOLOGY

**Student Materials**

- 25 living worms
- 25 gummy worms
- 25 Worm Observation Sheets
- 25 Magnifying Glasses
- Regular & colored pencils


Teacher Materials

- Paperclips -- 20 per table
- Read aloud: Wiggle Worms at Work, by Wendy Pfeffer
- Document camera
- 25 small plates
- Extra bag of gummy worms for students to eat
- Poster paper to record student observations

Use of Technology (where appropriate)

- Technology resources: Doc Camera

LESSON SEQUENCE AND PROCEDURES

Introduction (Hook)

So we have been taking a lot about observations and I have observed a lot of you doing and helping worms get back to dirt so that they don’t get stepped on by the other children at recess. Some of you have even been asking me questions about worms, so today we are going to learn a little bit about them and what they do to help our planet. First, we are going to need a book together. But before we get started, I want to hear what you already know about worms. Raise your quiet hand if you would like to share something that you know about worms. (2 minutes)

Sequence of Instruction (Step 1, Step 2...)

Step 1: Listen to student responses (have Lisa record this through video or quotes noting student names & what they say) (3 minutes)

Step 2: Read Wiggle Worms at Work (15 minutes)

Now that we have learned some facts about worms, we are going to look at a real worm under the document camera, but first I need you all to put on your science hats (not out putting on a hat million), and remember that great scientists are great observers. That means that we are looking closely with our eyes and we are paying attention to the tiny details of the worm. (2 minutes)

Step 3: Place live worm under document camera. “Raise your quiet hand if you would like to share an observation of the living worm.” “Teacher calls on students” (point out the different parts of the worm that were mentioned in the book if kids do not point this out: mouth, end where castings come out; (5 minutes)

Step 4: “Now, we are going to do a really awesome investigation with real worms and gummy worms. But first you will need to prepare two lines Investigation 1: 5 worms per group. Your teacher will provide 1 earthworm and 1 gummy worm (She/Her). You will get a gummy worm to make this investigation really fun! You can also share these gummy worms with a classmate (anticipated response: awesome!)

Step 5: “Now, we are going to share some important information about earthworms: Earthworms are an important part of the environment. They help to break down food waste into compost. (anticipated response: Yes!!)

Step 6: Pass out plates and send students to seats (2 minutes)

Step 7: Students will work on observation worksheet. They will need colored pencils, regular pencils and paperclips to measure the worms. Teachers will be walking around the room to monitor students as they observe and investigate the worms. (15 minutes)

Step 8: Transition. Workstations on rocking chair, leave all materials on the table including the worms. (Lisa will collect materials & worms while students gather on rug) Students wash hands (5 minutes)

Step 9: Discussion. Big paper poster already prepared with the sentence starters By worm, ___ students will have the opportunity to share what they noticed about their worms. (Possible sentence starters) (anticipated response: awesome!)

Step 10: Snack: Worms in dirt (pudding with gummy worm inside and cookie crumble). While eating at tables, students will be prompted to discuss what they learned about worms. (Possible: In the back of the read aloud there are fun facts about worms that I can share aloud with the class while they eat) (10 minutes)

Closure/Wrap Up

Clean quiet tables by heads down to be called for dismissal.

Independent Practice (where applicable)

N/A

Differentiated Instruction

Students will have the choice to use a magnifying glass if they wish, to get a closer look at their worm. Some students will need grown up writing (student will tell teacher what they meant to write and teacher will spell the words correctly underneath). Some students will need help forming letters, in which case, adults will write what they want to say in highlighter so that they can track over it.
Appendix H - Investigation 9: Reaction (Elephant Toothpaste)

During my time conducting science investigations with young children at the Discovery Space children’s hands-on science museum, I noticed most students really took a liking to the elephant toothpaste reaction investigation. This investigation is commonly referred to as the elephant toothpaste investigation because the reaction between the yeast, dish soap, warm water, and hydrogen peroxide, produces a foam like substance that squeezes out of the small hole of a soda bottle, making it look like toothpaste that an elephant would use! In our classroom, I refrained from calling it elephant toothpaste because I felt that the name was irrelevant to the focus of the investigation being the reaction.

Again, we focused on the science of chemical reactions and related vocabulary. This time students had a better idea of what the word reaction meant after conducting the Valentine’s Day reactions investigation. I set up a table where students could observe the reaction and the multiple steps to the process. I had students come up to the table to help me measure out ingredients (ex. ½ cup of hydrogen peroxide). I called up three student volunteers. Once all of the mixtures were ready, I had students make predictions of what they thought was going to happen when the ingredients were mixed together. After I had students share their predictions and explanations, I went ahead and added the ingredients together in a soda bottle. The reaction happened immediately. The reaction produced a foam-like substance that kept on squeezing out of the soda bottle for approximately 3 minutes. Students were amazed. As the reaction was happening, I called groups of three students up to the table for about 10 seconds to use their senses of smell, sight, and hearing to observe the reaction.

Once all students had a chance to observe the reaction up close, the class briefly discussed their observations. Once students had the opportunity to talk about what they had
noticed and why they thought the reaction happened, they had the opportunity to document their thinking in their science journals. This journal consisted of a blank page with the directions that they could draw and label a picture of something that they observed, or they could write about what they learned or what happened in our investigation, or both. I noticed that many students wrote down and drew pictures of the ingredients and materials we used to conduct the investigation. I was pleased to see students attempting to sound out and spell words like “hydrogen peroxide,” “yeast,” and “dish soap,” in their journals.

In this investigation, students learned that when the hydrogen peroxide and dish soap mixed together with the warm water and yeast, it caused a chemical reaction, signified by the production of gas bubbles. Students were able to connect this reaction to the reactions they witnessed in the Valentine’s Liquid Reaction investigation. Both investigations ultimately illustrated the crosscutting concept of cause and effect.
### Reaction (Elephant Toothpaste)

**Authors:** Hillary and her daughter  
**Date created:** 03/19/2016 8:04 PM EDT / **Date modified:** 04/11/2016 9:57 PM EDT

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**Summary**

Teacher will briefly talk to students about what a reaction is. Students will make predictions of what reaction might happen when we mix hydrogen peroxide, yeast, water, and soap in a bottle. Then the teacher will mix the ingredients in the bottle, and students will observe the reaction using their eyes. Students will then have the opportunity write in their science journals about what they observed.

---

### OUTCOMES/OBJECTIVES AND STANDARDS

**Objectives/Learning Outcomes**

- Students will be able to illustrate the reaction that they observed in their science journals.
- Students will be able to explain the process of the investigation (i.e. materials used and procedure taken) in their writing and/or conversation.
- Students will use descriptive language when talking/writing about the elephant toothpaste.

**Standards**

**PA- Pennsylvania Early Learning Standards**

**Key Learning Area:** Science  
**Standard:** Demonstrate understanding of the process of scientific inquiry  
**Indicator:** SC 1.1 Show curiosity by asking questions and seeking information  
**Indicator:** SC 1.2 Collect, describe and record information  
**Indicator:** SC 1.4 Make and verify predictions  
**Indicator:** SC 1.6 Use language that shows understanding of scientific principles  
**Indicator:** SC 1.7 Participate in scientific investigations

---

### Prerequisite Skills

- Students will need to know how to observe.
- Students will need to know how to listen and follow directions.
- Students will need to know what a prediction is.

---

### ASSESSMENT OF STUDENT LEARNING

**Assessment Activities/Rubric**

- Does the student use describing words in their science journal?
- Is the student using the word reaction in their science journal?
- Is the student drawing an accurate detailed picture of what they observed? (science journal)
- Is the student engaged in the investigation? (tracked by: hand raising, attentiveness, journal entry response, and discussion)

---

### MATERIALS AND TECHNOLOGY

**Student Materials**

- Blank sheet of paper  
- Colored pencils

**Teacher Materials**

- Poster & marker for student predictions  
- Elephant Toothpaste Ingredients:  
  - 16 ounce plastic soda bottle  
  - 1/2 cup 20-volume hydrogen peroxide liquid (20-volume is a 6% solution)  
  - 1 Teaspoon (one packet) of dry yeast  
  - 3 Tablespoons of warm water
Liquid dish washing soap
Food coloring
Small cup
Funnel

Use of Technology (where appropriate)

LESSON SEQUENCE AND PROCEDURES

Introduction (Hook)  
"Not too long ago in science we did an investigation with candy hearts. When we placed the candy hearts in the different liquids, it caused something to happen. Raise your quiet hand if you think you can remember that special word." Anticipated response: "Reactions" Yes we looked at reactions. Can anyone raise their quiet hand if they think they know what a reaction is... "Yes a reaction is when two or more things come together and something happens because of it. It is like a change!" (5 minutes)

Sequence of Instruction (Step 1, Step 2...)

Step 1: "Here I have a few different ingredients that I am going to mix together in this soda bottle. (introduce: hydrogen peroxide, water, dishwashing soap, yeast, and food coloring). Raise your quiet hand if you have a prediction about the reaction that we might see when we mix these ingredients. Remember a prediction is a guess, it doesn't have to be correct. (Take up to 5 responses) (4 minutes)

Step 2: "Shall we see!" (anticipated response: YES!!!) OK so here I have a measuring cup and a Tablespoon measure. I am going to ask a couple of volunteers to come up and help me measure out our ingredients. (Call 3 students up). Measure out ingredients. (3 minutes)

Step 3: "Ok kindergarten. I need you to put your science hats on. Your job is to observe what happens when we mix these ingredients together. You are going to stay seated in your tape seat with your legs crossed so that everyone is able to see the reaction. Do you think we are ready scientists?" (anticipated response: YES!!!) (1 minute)

Step 4: "Ok let's try it." (2 minutes)

Step 5: "Wow, raise your quiet hand if you want to share something that you observed." (Take 4 responses) "These are great observations. In your science journal page, I would like you to draw labeled picture, or write about the reaction that you observed when we mixed our ingredients. I would love to hear lots of detail in your journals, just like we spoke about yesterday before writer's workshop. When I hand you your science journal page you may find a seat. Make sure your name is on the back and you may get right to it!" (5 minutes)

Step 6: Students writing in their science journals (25 minutes)

Closure/Wrap Up  
Sharing student work under document camera

Independent Practice (where appropriate)  
N/A

Differentiated Instruction  
Some students will need more help identifying which to use for their science journal pages (students will tell teacher what they need to write and teacher will spell the words correctly beneath it)

Some students will need help forming letters, in which case, adults will write what they want to say in highlighter so that they can trace over it.
Appendix I - NAP Permission Letter for Table 2- Talk Moves

Figure 17 NAP Letter of Permission

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ACADEMIC VITA

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Education

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B.S., Childhood and Early Adolescent Education, Expected May 2016 (with honors)

Honors and Awards

• Dean’s List standing: The Pennsylvania State University, achieved all semesters

• Jeanne Leonhard Trustee Scholarship in Education recipient

• Graduation with High Distinction

Association Memberships/Activities

• PDS Intern August 2015-June 2016 State College, PA Easterly Parkway Elementary School
  • Teaching Elementary Science Leadership Academy (TESLA) Member
  • Rules and Regulations Security Leader (THON)
  • Schreyer Honors College Student Engagement Gateway Orientation Leader

Professional Presentations

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