Making Time for Science ‘Talks’

Jessica Donaldson
Radio Park Elementary, SCASD
Intern, Third grade
Penn State University
Jmd5003@psu.edu
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Description of Teaching Context

I am currently an intern in the Professional Development School Program, a partnership that exists between The Penn State University and the State College Area School District. I am an intern/co-teacher that teaches with Ms. Hershberger in a self-contained third grade classroom.

Our class is a unique and a diversified group of students with differing learning abilities and backgrounds. There are twenty-three students that make up this diverse classroom, 10 boys and 13 girls. In this classroom, there are thirteen students who have high level thinking related to science topics. However, there are only three students who are below grade level and five students who are meeting the standards at the third grade level. Throughout the regular instructional day, students float in and out of the classroom to meet with other specialty teachers to receive extra help with their individual learning needs. One boy receives additional help for speech practice once a week in the morning. This student also receives an advanced math class at the fourth grade level. Once a week, a total of six boys have math enrichment class with a cooperating teacher. Three girls receive additional help with word study and complete a specialized word study worksheet to meet their needs. Two students go to Title 1 for math and reading while one girl leaves for ESL class every day at 2:00 P.M.

For science in our classroom, we group the students by teams and sometimes by partners. These specific partners vary depending on the activity and how well the students work together. Most students in the classroom work well together as a team and learn from one another in group explorations as well as whole group science talks.
Wonderings and Sub-wonderings

Main wondering: How does leading effective science talks affect my students’ learning?

Sub-wonderings:
- How do I lead an effective science talk?
- How does scientific argumentation or scientific discourse affect a science talk?
- How does the amount of students that I call on during a lesson affect the participation and engagement of the students?
- Do students lead science talks more openly if the science talk is structured or more open ended?
- How do a novice and a veteran teacher differ in instruction with a science talk?
- Is there a difference in science talks at a first grade level compared to a third grade level?
Data Collection and Analysis

*Studiocode*

I used this excellent program to look at science lessons and analyze my questioning techniques, student responses, evidence, argumentation, transitions, and student participation. For each science lesson that I videotaped, I uploaded it onto my computer and then watched the lesson coding each aspect of the science talk in the program. Then I would revisit the coding and analysis with my mentor teacher and discuss our findings to make accurate claims about the science talk. Studiocode was my biggest piece of data collection tool, and it enabled me to easily analyze, review, and reflect on the science talk by adding comments on sections of the video. (Appendix A)

*Recorded discussions with Mentor Teacher*

After teaching the lesson, facilitating the science talk, reflecting upon the lesson, and coding the lesson with Studiocode, I would debrief the lesson with my mentor teacher by recording the discussion on GarageBand. This reflection and analysis technique helped me compare what I did in the lesson to what a veteran teacher would do in the same situation. In addition to this comparison, my mentor teacher and I brainstormed together to form goals for future science talks and discussed student reactions. I believe that debriefing the lessons after coding gave my mentor and me an opportunity to learn from each other, and it especially benefited me to talk through any wonderings about the science talk at this time. (Appendix B)

*Recorded student interviews*

I used the program GarageBand to record six students who were active participants in the science talks in my classroom. It was very important to me that I
received input on what the students thought about science talks and their perspective on the purpose of science talks. I asked several questions about their viewpoints on science talks and lessons that they did or didn’t like. I reviewed the interviews and found similarities between the six students’ answers; however, if given more time, I would have liked to interview the entire classroom to see everyone’s thoughts on science talks. (Appendix C)

**KLEW Charts**

After each lesson I analyzed, I took pictures of the KLEW* chart as evidence of the students’ learned information. KLEW charts are frequently used in the classroom as a way to record student evidence and explanation. Students also use a KLEW chart as a way to make public displays of student wonderings and reference to the chart often throughout science talks.

*KLEW stands for:
K: What we think we KNOW
L: What are we LEARNING
E: Our EVIDENCE
W: Our WONDERINGS
Explanation and Findings

In this section of the paper, I will discuss the claims and the evidence I found while exploring my wonderings as part of the inquiry process. I was unable to provide enough evidence for a few of my sub-wonderings to make a strong enough claim; therefore it was not included in this paper. However, for some of my sub-wonderings, I collected great evidence, but I felt more evidence would have made the claim stronger. These specific sub-wonderings will be addressed later in this section of the paper.

Claim:

Through analyzing the types and numbers of questions with Studiocode, I was able to increase the depth of questions asked during the science talks.

Evidence:

When looking at my data, I noticed how I grew with questioning the student’s in different ways to apply or expand their thoughts. After each lesson I coded the science talk with the program Studiocode and analyzed my questioning techniques. In my first lesson on shadows in October, I had a total of 11 probing questions and 16 summarizing questions. Later after gaining insight from a book called, Ready, Set, Science! I realized there are numerous ways I can question the students to apply their reasoning and increase student participation. (Appendix D). Throughout the year, I taught lessons and increasingly improved on asking more probing questions. For example, I taught a lesson on gears in March and asked the student’s 21 probing questions and 16 summarizing questions. Below are specific questions that I asked the students from these two lessons.

Probing questions from Shadow Lesson on October 30, 2007:

- “What else changed over the course of the day?”
- “Did the angles of the shadows change throughout the day?”
- “What is our evidence that our shadows changed throughout the day?”
- “Do you want to add on to that statement?”
• “What did we do to collect our data?”

Probing questions from Gears Lesson on March 3, 2008:

- “What are some machines that are made up of gears?”
- “Which gear is the driver gear?” “How do you know?”
- “Which gear is the follower gear?” “How do you know?”
- “What if I had a smaller gear and a bigger gear?”
- “How did you construct your machine?”
- “What would happen if I made a machine and the gears weren’t touching?”
- “What is the force that is applied?” “What’s your evidence?”
- “Do you think that affects the speed?” “Why?”
- “Do you agree or disagree with that statement?” “Why?”

The questions that I asked during the gears lesson enabled the students to think critically about how gears work together by explaining and providing evidence to support their claims. When providing scaffolding for good questioning techniques, students then adopt these skills and become more self-reflective learners when they ask their own questions.

Claim:

*Coding science talks with Studiocode has helped me think about the elements of a science talk and how I used it to deepen my students’ understanding.*

Evidence:

In the beginning of the year as I became increasingly interested in science and the elements of a science talk, I was introduced to the program Studiocode. When my science methods teacher informed me of the possibilities this program had with analyzing video, I started right away uploading science videos and coding science talks according to student evidence and explanation.

After gaining experience with science talks and discussing the components with my mentor teacher, I continued to add coding buttons such as: transitions of talk, teacher
probing, and summarizing questions (Appendix A). I noticed through not only coding my own science talks, but also other teachers’, that analyzing a science talk into components allowed me to think of one specific part of the science talk in its entirety. Coding lessons also gave me concrete ideas on how a science talk is led and what I needed to include for students to gain a deeper understanding about a concept. Studiocode gave me the opportunity to listen to the science talk and look at the elements, which made it more explicit.

Teaching science as inquiry is a challenge in itself because the teacher needs to challenge students’ thinking and ask several probing questions to engage students and increase participation. Studiocode sets up opportunities for me to reflect on ways to challenge students’ thinking by asking for evidence based explanations.

As I continued to teach and code science talks, I noticed that prediction and argumentation are also important aspects of a science talk. Students’ predictions are very important aspects of a science talk, which enables students to focus their minds on the driving question. Argumentation is also important because it is found to have cognitive values in science education and was researched by Jonathan Osborne in 2004. These two elements are important components of a science talk, but are only apparent depending on the nature of the content and on the students. However, if I included these two coding buttons in my analysis earlier, I might have found more accounts of argumentation. I believe including these coding buttons in the code input at an earlier time would have made me more comfortable with the possibility of having scientific arguments in my classroom. Also knowing what I know now, I would question some students further and ask all students to agree or disagree with a statement and explain their reasoning.
Opening up this discourse during a science talk allows misconceptions to surface and then address them as class wonderings.

**Claim:**

*Allowing time for initial mini-science talks on predictions allowed students to focus on the driving question for the lesson.*

**Evidence:**

For several science lessons that I taught, I asked the students to make predictions in the experiment, which was linked to an initial driving question. At this time in the science talk, it was important to have several students concentrate on their thoughts that way they could be actively involved in what they noticed after experimenting with the question. In the penny lever lesson that I taught, it was also important to ask a number of students their predictions and thoughts. Not only should the students be thinking of a prediction, but they should base their prediction on logical reasoning. This teaching style is what makes the difference between inquiry-based science and the traditional science teaching. Having students think critically and give justifications as to why they made a specific decision challenges students to take a different scientific viewpoint in which most people are unfamiliar. Looking back on previous lessons, I found that students who contributed with their predictions were applying their previous knowledge to the presented question. For example in the penny lever lesson, I asked a student, “What are you thinking? Will the amount of pennies increase or decrease?” The student said, “Since it’s easier with more distance and I’m starting with the load closer to the fulcrum, it will increase because it will add more weight to the bucket to tip the load.” This specific
student used his knowledge from previous lessons to discuss levers, and he provided a great reason with his prediction.

**Claim:**

*Inclusion of existing scientific knowledge after students explore and investigate increases students understanding of a concept.*

**Evidence:**

In all science lessons I began with a driving question and then further investigated the question by doing hands-on and minds-on activities that create in-depth discussion about the initial question. Starting with a question for each lesson is critical because that allows students to think independently about the question and explore the concept. For example, in the rocks and minerals unit that my third graders have been investigating, we started with a sorting activity and asked the question, “What is a rock?” When doing this sorting activity, it generated numerous wonderings that were all interconnected to the lessons that follow within the unit. After we gathered as a class and discussed how the students sorted the materials, I incorporated existing scientific knowledge, which was found on the Internet and also in books. These resources gave students concrete evidence that could be linked to the learned information in the educational materials. One of the resources I included in the rocks and minerals unit was a website that explained that all rocks are minerals, but not all minerals are rocks. That sentence in itself created great discussion about why that statement is true.

An inquiry setting aims to promote active learning by increasing student involvement and making the students’ thinking public. When using student-derived investigations, the lesson is more relevant and meaningful to the students. In this
curriculum, student investigations lead to active co-construction of meaningful knowledge instead of immediately including the educational resources and telling the students the information. Science teaching in this way enables students to have a deeper understanding because it builds on their previous learned knowledge.

Claim:

*Scientific argumentation does not occur during every lesson, but when it does it has the potential to create critical thinking discussions and generate several wonderings.*

Evidence:

Throughout my evidence, I do not have many accounts of scientific argumentation occurring during the science talks; however, when it did occur, in-depth conversations and debates were present. When two or more students are presented with something they do not agree on, it enables a time to share their thoughts and to process and learn about others’ ideas. I found that argumentation not only is located in a third grade setting, but also in first grade. However, there is a recognizable difference in the argumentation that happens in first grade compared to third grade. At the third grade level students take a defensive stance and argue about who is right or wrong, but first graders said whether they disagreed and why.

The third grade argumentation took place during a rocks and minerals lesson. A student began the argumentation by making the statement that he thought a diamond was the strongest thing on earth and wanted to add that statement to the K column of the KLEW chart while another student thought differently.

D: “A diamond is the strongest thing on earth.”
K: “No way, it’s not the hardest thing on earth.”
T: “Are you sure?” Student in background
“*Why do you think that statement is not true K?*”
K: “Because I heard human bones and cement are the hardest things on earth.”
D: “No that’s not right, that’s not right.”
“I think that may be an important wondering to include on our KLEW chart. Is a diamond the hardest thing on earth?”

The following first grade argumentation took place during the introduction of the sound unit. The teacher asked what they thought they knew about sound. A student began to talk about the specific parts of the ear and how they assist in hearing sounds. The argumentation dialogue is located below.

R: “There is something how you hear out of your ear.”
J: “What is that?”
R: “There’s this thing kind of like a shell and the sound vibrates and it goes to a nerve in your brain and then you know its sound.”
J: “There’s a shell?”
R: “It’s something like a shell.”
K: “It’s an eardrum.”
R: “I don’t think it is a eardrum, I think the part its shaped like a shell.”
J: “Where is this shell?”
R: “It is inside your ear.”
J: “Oh. Okay. So there are parts that are inside your ear that help you hear.”

There are significant amounts of research showing that argumentation is a critical tool for science learning because it enables appropriate practices of building a community of scientists and encourages scientific discourse. Jonathan Osborne has found evidence and reasons why argument is a good feature to have in science talks. He states, “From the cognitive perspective, to the extent that argument involves the public exercise of reasoning, lessons involving argument will require children to externalize their thinking. Such externalization requires a move in and out psychological planes and then develops into a dialogic argument. Furthermore, to grasp the connection between evidence and a claim is to understand the relationship between claims and evidence sharpens the children’s ability to think critically in a scientific context.” (TAPping into Argumentation, Jonathan Osborne)
Claim:

*Science talks look and sound very similar across first grade and third grade levels.*

Evidence:

After observing and coding science talks in both first grade and at the third grade level, I found there are many similarities and only a few differences between the two. The similarities between the grade levels are the components of a science talk and the nature in which the students speak about the scientific phenomena. Science talks normally contain questioning, transitions of talk, predictions, evidence, and explanation. When observing the first grade classroom, I decided to keep the coding buttons in Studiocode consistent throughout my grade level observations to see if there was a comparison from first grade science talks to third grade science talks.

As I reviewed the matrix of the two lessons that veteran teachers taught, it was possible to view the coding buttons and see that all of the components were similar except for the explanation code button (Appendix E). In this first grade classroom, I have observed that their science talks are a scientific discussion without many raised hands. Numerous classrooms are able to maintain this style of science talks; however, some are not, and is why the first grade classroom has more explanation.

The differences between a first grade science talk and a third grade science talk is the usage of the word, evidence. Third graders use evidence throughout their explanations and also frequently use the word evidence to refer to their data. At the first grade level, I believe students pick up the scientific language from their teachers, but then start to include this specific language than at a later age.
Implications for future teaching

From this inquiry process I have seen how analyzing and reflecting upon my questioning has strengthened my teaching and made me more comfortable with inquiry-based science teaching. Leading an effective science talk is extremely important for student understanding to occur and this inquiry has given me the opportunity to use several tools to analyze and learn more about science talks. I plan to incorporate inquiry-based science where ever I may be next year and throughout my teaching career. Teaching science in this cooperative learning style has really enlightened me and makes me enthusiastic about teaching science. I can not wait to build my own community of scientists next year!

New Wonderings

Throughout this inquiry investigation I constantly analyzed my questioning techniques and how the students responded to my questions during a science talk. During this process, I have explored both my main and sub-wonderings and derived more questions from inquiry. My new wonderings include:

- What activities or questions help generate a significant amount of student wonderings?
- Could a science talk take other forms throughout the classroom and be adapted to other subject areas?
- Do science talks help students connect evidence in other content areas?
- How can I foster and encourage more scientific argumentation to occur?
- How will a new class adapt to science talks?
Appendix A
Appendix B

Recorded Discussion with Mentor Teacher

J: As I looked at the science talk I realized that I needed to ask more probing questions and have students include specific evidence with his/her explanation.
J: When I look at the difference between probing and summarizing I realized I needed to ask more probing questions.
K: It is helpful to turn back to the classroom and ask did anyone else notice that? Do you agree or disagree? Why or why not?
K: Listening to the kids and to keep in mind where you want to go with the science talk.
K & J: Realizing the difference between science talks that some lessons have more data and others don’t, however, evidence can be located within explanation.

Appendix C

Student interview questions:

- Do remember the gears lesson?
- What did you like about it? What didn’t you like about it?
- Why are science talks important?
- When you’re talking about science what is important to share? Why?
- What do you think are the important parts of science?
- Do you like lessons like the gears where it is more open-ended or do you like lessons like the penny lever lesson that has you answer a driving question? Why?
- If you come to a problem how do you think is the best way to solve it? How do you like to solve it?
- What do you think the purpose of a KLEW chart is?

Student Responses

T: I liked when we built the machine. Because at first we had problems because we couldn’t get it to work, but then the next morning we came back to it and figured it out and got it.
J: What didn’t you like about the gears lesson?
T: I didn’t like really when we couldn’t figure it out at first. Because it was hard at first, getting to my mind and acting like I couldn’t do it. But we stuck with it and figured it out.
T: Well science talks are important because it helps us get our minds ready for the science experiment we’re doing. Like if we didn’t have our science talks we wouldn’t know what to do exactly. For example the rocks lesson we had to have the science talks before so we would know what to with the vinegar. We have science talks so we can figure out what to do in the experiment.
T: It was hard for me because a lot of people in my group didn’t agree with me because we had different opinions. We just couldn’t figure it out so it was hard.
**J: Do you like working with other people in science?**
T: Sometimes and sometimes not. Sometimes we argue and it gets pretty loud. But other times we can agree and it is good to work with other students.
T: Science isn’t really for the grade it about having fun and doing experiments.
T: We should just try to work out our opinions, see who likes it and who doesn’t and if it is a tie we’ll ask a teacher to see. But usually we would normally have to work it out on our own talk to each other see what we think. See who has the better opinion instead of just saying you think that.
T: Yeah.
T: The KLEW chart really helps us, let’s say we didn’t know that all rocks are minerals but all minerals are rocks. If we didn’t write that down we might have forgotten it and then we wouldn’t know if that was true or not again.
**J: So using it as a reference?**
**J: Do you think the evidence and wonderings are important to include.**
T: Yes it is really important. Evidence tells you why you explained that and how you got the learned. And for wonderings its really important because it is a wondering and you’re not sure of the answer so you need to write it down so you don’t forget it.

E: I liked how we got to make different things using the gears to solve the problem but got to use different gears. There were also different types of gears that could work in the same way, but also in different ways
E: I think I it is important to share what you think you learned because other people might have done it a different way and then you get two ideas out of it instead of one.
E: Important parts are to make observations and also predictions.
E: She likes more open-ended lessons because she gets to make something on her own and then also gets to learn how others came to a conclusion.
E: To make sure you don’t forget any of the information so if you did forget you could just look up there and remember it and to have your evidence and wonderings.
**J: Do you think evidence and wonderings are an important part of the KLEW chart?**
E: You need evidence to make sure you learned something and you need wonderings to learn more

G: She really liked to see how the gears moved to make the fan work and to see what was in the fan. I also liked working with others because it was hard to construct.
G: I think it is important to answer the important questions and wonderings and bring your own wonderings to the science discussion to the entire class to solve it as a group.
G: I think it is important to share questions and what we did during science experiments. G: I think it is important to find out problems because it can help you in the future so it doesn’t happen again and it is important to get together and discuss what you did in science because you might have some wonderings or other students may have wonderings.

G: I prefer the driving question lesson so I can focus on one question and then move onto other wonderings I have.

G: Well if you have a question you put it on the KLEW chart and then you won’t forget questions you had and then you can refer to it as you answer the wondering.

J: So we can review what we learned about it, if something else learned something and you didn’t know about it we could share it so everyone can learn from it too.

J: I like both and it really depends on what we are doing.

J: Well you have to brainstorm with others to solve a problem in science.

Jo: I like the open-ended lesson because it helps you to know what you’re thinking and discuss it with other people and what you’ve done a great job on.

Jo: I like to play around with the question and I improvise and brainstorm

Jo: I believe solving a problem it is easiest to do the hard stuff first and then work on the rest.

Jo: I thought it was kind of cool because we could build the things open-minded as long as it followed the rule on the cards.
Appendix D

Questioning examples from Ready, Set, Science!

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<th>Talk Move</th>
<th>Example</th>
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<tr>
<td>Revoicing</td>
<td>“So let me see if I’ve got your thinking right. You’re saying ________?” (with space for student to follow up)</td>
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<tr>
<td>Asking students to restate someone else’s reasoning</td>
<td>“Can you repeat what he just said in your own words?”</td>
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<tr>
<td>Asking students to apply their own reasoning to someone else’s reasoning</td>
<td>“Do you agree or disagree and why?”</td>
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<tr>
<td>Prompting students for further participation</td>
<td>“Would someone like to add on?”</td>
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<tr>
<td>Asking students to explicate their reasoning</td>
<td>“Why do you think that?” or “What evidence helped you arrive at that answer?” or “Say more about that.”</td>
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<tr>
<td>Using wait time</td>
<td>“Take your time.... We’ll wait.”</td>
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Appendix E

![Image of graphics related to science talk]

Judi Kur Sound Lesson, Apr, 7, 2008 10:21:58


<table>
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<th>Code 1</th>
<th>Question</th>
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Appendix F

Purpose/Rationale:

As an intern and growing teacher, I became very interested in the subject of science during these past two semesters. Teaching science through inquiry is very enlightening and sparked many questions about teaching methods and techniques. I thought to myself, not only do I want to learn about how to teach science but also how students learn science in an effective and engaging way. Throughout observation and analysis of my mentor’s science lessons, I realized students engage and learn a lot from participating in science talks. This specific observation triggered the basis of my wondering, how is a science talk structured and how does it affect student learning? I am motivated to make science topics a challenge through experiments and discussions to further student thinking and understanding.

Context:

I am currently an intern in the Professional Development School Program, a partnership that exists between The Penn State University and the State College Area School District. I am an intern/co-teacher that teaches with Ms. Hershberger in a self-contained third grade classroom.

Our class is a unique and a diversified group of students with differing learning abilities and backgrounds. There are twenty-three students that make up this diverse classroom, 10 boys and 13 girls. In this classroom, there are thirteen students who have high leveled thinking related to science topics. However, there are only three students who are below grade level and five students who are right on with grade level expectations. Throughout the regular instructional day, students float in and out of the classroom to meet with other specialty teachers to receive extra help with his/her individual learning needs. One boy receives additional help for speech practice once a week in the morning. This student also leaves to go to an advanced math class at the fourth grade level. Once a week, a total of six boys leave for math enrichment with a cooperating teacher. Three girls receive additional help with word study and complete a specialized word study worksheet to meet their needs. Two students go to Title 1 for math and reading while one girl leaves for ESL class every day at 2:00.

For science in our classroom, we group the students by teams and sometimes by partners. These specific partners vary depending on the activity and how well the students work together. However, we try not to group the two students that go to Title 1 and the ESL (English as a second learner) student together because they miss some of the science instruction due to the additional help they are receiving. Most students in the classroom work well together as a team and learn from one other in group explorations as well as whole group science talks.

Main Wondering:
How does leading effective science talks affect my students’ learning?
Sub-wonderings:

- How do I lead an effective science talk?
- How does scientific argumentation or scientific discourse affect a science talk?
- How does the amount of students that I call on during a lesson affect the participation and engagement of the students?
- Does students lead science talks more openly if the science talk is structured or more open ended?
- How do a novice and a veteran teacher differ in instruction with a science talk?
- Is there a difference in science talks at a first grade level compared to a third grade level?

Data Collection:

Main Wondering:

How does leading effective science talks affect my students’ learning?

- Studio code
- Journals and reflection on science lessons
- KLEW charts
- Debriefing lessons with Ms. Hershberger on GarageBand
- Observations
- Student interviews

Sub-wonderings:

1) How do I lead an effective science talk?

- Studio code
- Journals and reflection on science lessons
- KLEW charts
- Debriefing lessons with Ms. Hershberger on GarageBand
- Observations

2) How does scientific argumentation or scientific discourse affect a science talk?

- Studio code
- Journals and reflection on science lessons
- KLEW charts
- Debriefing lessons with Ms. Hershberger on GarageBand
- Observations
- Student interviews

3) How does the amount of students that I call on during a lesson affect the participation and engagement of the students?

- Studio code
- Journals and reflection on science lessons
- KLEW charts
• Debriefing lessons with Ms. Hershberger on GarageBand
• Observations
• Student interviews

4) Does students lead science talks more openly if the science talk is structured or more open ended?
• Studio code
• Journals and reflection on science lessons
• KLEW charts
• Debriefing lessons with Ms. Hershberger on GarageBand
• Observations
• Student interviews

5) How do a novice and a veteran teacher differ in instruction with a science talk?
• Studio code
• Journals and reflection on science lessons
• KLEW charts
• Debriefing lessons with Ms. Hershberger on GarageBand
• Observations

6) Is there a difference in science talks at a first grade level compared to a third grade level?
• Studio code
• Journals and reflection on science lessons
• KLEW charts
• Debriefing lessons with Ms. Hershberger on GarageBand
• Observations

Method:

I will be teaching several science lessons and recording them on video. After each lesson, Ms. Hershberger and I will code the science talk through the program Studio Code and analyze the students’ discussion. Next, we compare our data and discuss our findings with one another. My goal is to encourage scientific argumentation and allow students to take on different roles during science talks.

Projected Timeline:

January/ Beginning of February

January 7-11
• Find and read literature on science talks, scientific argumentation, and scientific discourse.

January 14-18
• Videotape and code Ms. Hershberger’s science talks.
• Debrief lessons with Ms. Hershberger on GarageBand.
• Observations.

January 21-25
• Participate in Lever stations and make observations.
• Begin to generate sub-wonderings.

January 28- Feb 1
• Observe and participate in Lego lesson.
• Continue to find literature on science talks, scientific argumentation, and scientific discourse.

February/ Mid March

February 4-8
• Videotape and code my science talks on levers.
• Debrief lessons with Ms. Hershberger on GarageBand.
• Record on a KLEW chart.
• Write in journals and reflect on science lessons.

February 11-15
• Observe and participate in pulley lessons that Ms. Hershberger teaches.
• Read and find more literature.

February 18-22
• Teach pulley lesson to another third grade classroom
• Videotape and code my science talk about pulleys.
• Debrief lesson with Ms. Hershberger on GarageBand.
• Debrief lesson with Mrs. Burns.
• Record on a KLEW chart.
• Reflect on science lessons.

February 25-29
• Videotape and code Ms. Hershberger’s science talk about pulleys with Miss. Huber’s classroom.
• Compare the science talks from Mrs. Jobe’s and Miss. Huber’s classroom.
• Go back through science talks and see how many times girls participated and how many times boys participated.
• Look through the science talks to see the amount of times people participated in the science talk.
• Look through the science talks to see how many different people participated in the science talk.
• Debrief Ms. Hershberger’s lesson with her.
• Continue to read more literature about scientific argumentation.
• Finish inquiry brief and annotated bibliography.
March/ Beginning April

March 3-6
- Continue to collect data by videotaping my science lessons.
- Debrief lesson with Ms. Hershberger on GarageBand.
- Record KLEW chart.
- Reflect and analyze science lesson(s).
- Look at science talks in a first grade setting.
- Code and debrief first grade lesson with Mrs. Kur.

March 17-20
- Continue to collect data by videotaping my science lessons.
- Debrief lessons with Ms. Hershberger on GarageBand.
- Record KLEW chart.
- Reflect and analyze science lesson(s).

March 24-28
- Continue to collect data by videotaping my science lessons.
- Debrief lessons with Ms. Hershberger on GarageBand.
- Record KLEW chart.
- Conduct student surveys.
- Reflect and analyze science lesson(s).

March 31- April 4
- Continue to collect data by videotaping my science lessons.
- Debrief lessons with Ms. Hershberger on GarageBand.
- Record KLEW chart.
- Conduct student surveys.
- Reflect and analyze science lesson(s).

April 7-11
- Finalize data collection.
- Work on inquiry paper.
- Continue to collect data by videotaping my science lessons.
- Debrief lessons with Ms. Hershberger on GarageBand.
- Record KLEW chart.
- Reflect and analyze science lesson(s).

April 14-18
- Finalize any data collection.
- Work on inquiry paper.

April 21-23
- Finalize inquiry paper for April 23rd.
Appendix G


a) From reading this article I can understand that argumentation is not just standing up for what you are thinking, instead it shows the background knowledge of the students who are participating in the argument. This journal article could help me understand how students’ argumentation relates to what they’ve learned in the lesson. Not only could I understand how this relationship occurs, but it also would enable me to point out when it occurs during the lessons I teach.


a) “The power of questioning” article allowed me to see the true importance of questioning. This specific article did not talk about how to ask the “right” questions at the right time; however, it talked about how to listen to students during experiments to turn his/her statements into wonderings. “The power of questioning” has given me insight on what I need to focus on during student explorations and it could also help other teachers learn how to really listen to his/her students’ wonderings. Listening to and questioning students has become one of my focuses during the science lessons I teach and this article will help me further my questioning abilities.

I found this article and decided it would be a great resource for welcoming scientific argumentation into classroom science talks. The article gives valid reasons why scientific argumentation needs to be included in every science talk in your classroom. The authors discuss the purpose of dialogic argumentation in that it enhances student’s knowledge and gives students the ability to improve scientific literacy. Scientific argumentation is a needed aspect in science talks and this article gave me ideas on how to foster this discourse.


This article was based on a research project about enhancing the quality of argument in school science. It also includes researchers findings about an argument pattern in science classrooms. Located in this article are various types of research that proves how and why scientific argumentation improves student scientific knowledge. These authors involved have refined and developed methodologies for the analysis of argumentation in the science classroom. This specific resource will help me understand the patterns of argumentation and learn how and why scientific argumentation improves student’s scientific knowledge.


This article justifies as to why you as a science teacher should make the time to include science talks into your daily science instruction. In addition, it can also contribute to
teacher background knowledge about how to conduct a science talk and how students benefit from engaging in meaningful science talks. “Making time for science talk” gave me evidence as to why I should take time to include science talks in my science lessons. Not only does it give me evidence, but it also gives me an idea on how to begin science talks in a new classroom.

a) “Talking their way into science” is a great book that I found in the school library. The book contains the anatomy of a science talk, great questioning techniques, and ideas on how to construct discourse, which are all components of an effective science talk. Growing and veteran teachers could learn a lot about science talks from this book and then incorporate it into his/her own classroom. I plan to use this book’s ideas about science talks and then experiment with the techniques and strategies in the students’ science talks in my classroom.

a) This article that is located underneath the Methods and Strategies section of the magazine Science and Children is about evidence and how to organize evidence and learned information. In the past, many science teachers used Know-Want-Learn charts during science to access students’ prior knowledge on a specific topic. Now teachers developed a new variation, which is the Know-Learning-Evidence-
Wonder (KLEW) chart. I’ve used this new variation for teaching science since my science methodology course and I feel it is an organizing way to show students ideas and knowledge. This article provides evidence that students utilize the KLEW chart during explanations and students writing became more in depth about the science topic. The authors give me numerous insights on how this movement started and the reasoning behind the KLEW chart.


a) Judy Kur and Marcia Heitzmann are teachers who are located in my own teaching community. These two women wrote an article about student wonderings and how to choose which wonderings are appropriate and testable. Their ideas about wonderings will help me encourage students to question and brainstorm new ideas. In addition to learning about student wonderings, it will also give me a sense of how science talks are facilitated at the first grade level. I plan to take these ideas about student wonderings and apply them in my own classroom and other classrooms. This article will give me more knowledge about wonderings and help me learn how to attract them from the students.


a) The chapters located in the book “Ready, Set, Science!” will be extremely helpful in my inquiry on science talks and scientific argumentation. There is one whole chapter devoted to making thinking visible: talk and argument, which is a small focus of my inquiry. In addition to this specific chapter, there is a section that includes knowing how to teach
science effectively. This resource I believe will become the base of my research related to my science wonderings.

The right questions at the right time. (n.d.). In Taking the plunge: how to teach primary science more effectively. (Reprinted from Taking the plunge: how to teach primary science more effectively, pp. 36-46, by J. Elstgeest, 1985, Heinemann)

a) “The right questions at the right time” a chapter located in the book Taking the plunge, will be of great assistance to see how the author describes how to ask the right questions during science talks. This particular chapter is also related to my sub-wondering on how novice and veteran teachers differ in instruction. One difference I know between novice and veteran teachers is the questioning techniques. This chapter may help me take the next step in my questioning abilities during science talks and compare more differences between novice and veteran teachers.


a) Science workshop book is devoted to reading, writing and thinking like scientists. This book about teaching science through inquiry gives teachers great resources about fostering inquiry in your own classroom. Also an entire chapter is devoted to resources for teachers and it provides several books, magazines, journals, websites and much more! When reading a section of this book I realized that science talks couldn’t occur if you as a teacher do not develop a community of scientists. Without a classroom community the students will be hesitant to participate in science talks and scientific argumentation. In reading this book, I will gain knowledge on how to build a community of scientists in
classrooms in the future, and also have the opportunity to strengthen the community in my classroom this year.