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Inquiry-Based Learning: Effects on Student Engagement

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Abstract

Inquiry-based learning is an approach to science instruction that has been around for over 40 years and has many positive aspects, including: critical thinking, student achievement, positive attitudes towards science, and student engagement. Inquiry-based learning has four different levels and is an instructional method that provides a problem or question which allows students to complete an investigation. This action research project will explore how inquiry-based learning affects student engagement and how student's feel about inquiry. Students were taught with two days of traditional instruction, two days inquiry-based instruction, and then given a pre-survey and post-survey, and observed using an engagement scale. Overall, students scored better on the post-survey and had a higher rating for engagement. These results indicate that students showed greater engagement during the inquiry-based learning days.

Introduction

Engagement within the classroom greatly impacts student performance and participation. Students thrive when they are able to create their own knowledge through exploring and engaging with materials. However, within a traditional science classroom, material and content are taught through lectures, worksheets, and reading out of a textbook. These monotonous methods have led students to be disengaged and have a lack of interest in what they are learning. Thus, why are more teachers not using the inquiry-based approach? Inquiry-based learning allows students to work with peers, collaborate, and learn communication skills. These methods allow students to construct their own knowledge, which leads to better retention of science concepts and greater involvement in the learning process. Through inquiry-based learning in a middle childhood classroom, can a teacher effectively increase student engagement in the science content being learned?

Traditional approaches to science education are lackluster. Students can sit through a lecture and not absorb any of the information. Within inquiry-based learning, students are analyzing results and coming up with their own conclusions in order to answer a research question (Bell, Smetana, and Binns, 2005). During this process, students are using problem solving skills and critical thinking to draw conclusions. As an undergraduate student pursuing a Bachelor of Education, I have observed multiple classrooms. One thing in common with these classrooms was: none of the teachers used inquiry. In my “Introduction to Science Education” course, my professor, Dr. Emilio Duran, set up three levels of inquiry, each progressively giving students more choice. From one level to the next, my group and I started to communicate more and become immersed in the activity. After seeing my group become more engaged, I was curious to know if middle grades students would react the same. Therefore, in my project I

investigated whether students were more engaged in inquiry-based learning compared to traditional methods and how students felt during both.

Literature Review

Inquiry-based learning has been around for over 40 years and since the beginning has acquired a sizeable amount of research. The research ranges from student achievement, to critical thinking, to engagement, to perception of science, all the way to attitudes towards science. However, research on student engagement as a result of inquiry-based learning is limited. Engagement in the classroom means that students are paying attention, being on task, and participating throughout the lesson; they are not merely sitting and listening.

Schools and teachers all have various approaches to teaching science content using the inquiry-based method. However, there is an array of options that teachers can choose from to implement this instruction. Students do not always need to be designing their own investigations, rather there are many levels of inquiry that can be implemented and should be progressed towards (Banchi & Bell, 2008). Typically, teachers struggle with using this approach due to planning and timing because it is much easier to prepare traditional instruction before the class. However, there are many levels of inquiry that can be incorporated into a classroom, that would allow students to further their knowledge and remain engaged.

There are four different levels of inquiry and with each successive level comes more student independence. The first level is confirmation inquiry, where students are given most of the information including: the question, procedure, and what the results should be (Banchi & Bell, 2008). Teachers can implement level one as a final activity, wrapping up a concept that was already learned. The second level is structured inquiry, where students are given a question and a prescribed procedure. Moving up, the next level is guided inquiry, and students are only given

the question; leaving a lot of room for student ownership (Bell, Smetana, & Binns, 2005). The final level is open inquiry, where students create their own questions and have the most freedom to decide (Banchi & Bell, 2008). Each of these levels, builds on one another which requires teachers to take inquiry learning step-by-step and complete each level before moving on.

"Students will reap as little benefit from being thrown unprepared into Level 4 inquiry activities as they will from being held at low-level activities" (Bell, Smetana, & Binns, 2005, p. 33). Therefore, teachers need to build up student comfort in each level, being sure students are focused on their tasks throughout. To keep the progression harmonious and smooth, teachers can go through all levels within one science topic and require students to get their procedures approved. By structuring the activities successively, students will build-up their comfort for having progressively more freedom. Inquiry-based learning has various levels to utilize and each has high amounts of student engagement, whereas traditional lectures do not.

Traditional methods of teaching, lectures and teacher-centered approaches, no longer work. Children require more student-centered approaches to fully understand and interact with the content. Lectures are not cutting it anymore. Learning scarcely happens in lecture settings because the audience is passively sitting and listening, "it fails to engage fully the minds of students. Put simply, it is difficult to learn if one is not engaged" (Sciullo, 2017, p. 238). Students have a hard time paying attention, let alone learning, if they are not engaged and enjoying the lesson. Teachers need to shift their focus to a more interactive approach, where students are doing most of the talking. By allowing students to take over, students feel more independent and self-directed, guiding their own learning (Stearns, 2017). Inquiry-based learning allows students to use their curiosity to guide their questions and their learning. Students are more engaged when they create their own experiment and can direct activities towards their

interests. Therefore, lectures and traditional approaches should be minimized and shifted more towards inquiry-based, student-led learning.

One potential of inquiry-based learning is that its implementation has the ability to increase student's critical thinking skills. A study done by Meltem Duran and İlbilge Dökme (2016) found that inquiry-based learning increases critical thinking skills as compared to traditional teaching. During this study, one group of students was taught using traditional lecture and a second group was taught using the inquiry-based method, each student was given a pre- and post-test to gauge their critical thinking skills (Duran & Dökme, 2016). After analyzing the results, Duran and Dökme (2016) regarded the increase in critical thinking skills from the inquiry-based learning to students' active engagement with the lesson, through discussions that required greater student reasoning. Students are more active throughout the lesson because they are the controllers of where their experiment is going. Students are asking the questions and choosing the direction; thus, these require them to be constantly thinking about where they are headed and where they should go next. Tyler DeWitt (2012) mentioned in his TED Talk, that students have a better chance of understanding information when it is more fun and engaging, and the language is put into simpler form. Students have the ability to discuss and explain ideas better to each other than a textbook or lecture could. Inquiry-based learning drives peer discussion and leads students to propel their own learning, becoming owners of their new knowledge. Further, another positive attribute to inquiry-based learning is that students' academic achievement regarding content knowledge increases.

Due to the high level of participation demanded from inquiry-based learning, students are more likely to increase their content knowledge. These positive results can be seen in previous research by Deborah Maxwell, Dawn Lambeth, and J.T. Cox (2015) in their study

which found “that students taught with IBL [inquiry-based learning] methods scored higher on content knowledge assessments as compared to students taught in a traditional manner” (p. 25). Students involved in inquiry-based learning are exposed to various viewpoints and perspectives from their peers, allowing them to acquire more content than a typical lecture. Therefore, they are exposed to science standards and ideas from their peers, inherently gaining more knowledge of that topic. It was even shown in a separate study that through inquiry-based learning both low-achieving and high-achieving students showed greater academic progress in a particular science content (Barron & Hammond, 2008). Meaning, that all students can gain from this process of learning, which is due to the various approaches that can be taken. Students learn better when they are given a choice and can adapt the activity to their learning styles. Specifically, inquiry-based learning allows teachers to adjust the level of student independence, allowing teachers to maintain control and guide students towards learning. Therefore, teachers are there to redirect and formatively assess that students are observing and learning the science concepts.

Another positive result of implementing inquiry-based learning is that students’ attitudes towards science could become more positive. One study found that inquiry-based learning compared to the traditional teaching method had “much more positive effects on attitudes of the students towards science” (Aktamiş, Hįğde, Özden, 2016, p. 257). Attitudes changing in such a setting are the result of being more interactive and by having a chance to take ownership for their learning. Teachers want to foster an appreciation for learning and allow students to have a voice within the classroom. Students enjoy being given meaningful work and deciding what they get to learn. Therefore, when students get to decide the approach to a problem they are more likely to take it seriously and develop a sense of why science is useful, increasing their attitude towards learning the concepts. A separate study even indicated a level of excitement from students,

mentioning comments that showed enthusiasm due to the concepts finally making sense (Maxwell, Lambeth, & Cox, 2015). Therefore, inquiry-based learning increases student's perception of science, leading to a more positive mindset.

Inquiry-based learning also has the chance to increase student engagement throughout a lesson. Engagement means students are actively participating and interacting with their peers, while remaining on task and not being disruptive. Since students enjoy having input on their activities they are more likely to be active and involved. Buchanan, Harlan, Bruce, and Edwards (2016) discuss that allowing students to complete an investigation, may lead them to fail, which then requires them to rethink their research and learn from their mistakes. Inquiry-based learning leads students to possibly fail and re-do, allowing them to learn from their mistakes. Mistakes help a person see what went wrong and inherently remember the content later next time. Therefore, students must be engaged throughout the entire process and thinking ahead to ensure that what they are doing makes sense. During traditional approaches, students can be seen to be more off-task or spending extra amounts of time repeating the same task. This behavior amounts to lost time learning and greater student confusion because students are more confused by unclear directions (Maxwell, Lambeth, & Cox, 2015). Inquiry-based learning leads to more time learning because students guide the activity and set the directions. Therefore, inquiry-based learning results in greater levels of participation, on-task behavior, and overall engagement.

Looking at the scope of inquiry-based learning, there are many aspects that are positive, but there also remain aspects that are negative. Some negative aspects are teachers' preparation time, funding for materials, and misunderstanding of how to implement inquiry-based learning. Teachers are not always adequately prepared to run more student-led lessons because they themselves are inexperienced and unsure of where to begin. Previous research, although detailed,

has failed to mention possible obstacles that teachers must face using inquiry-based learning. The researchers have highlighted the positive results of inquiry-based learning, failing to mention if there are any difficulties to begin teaching this way. The lack of difficulties calls to research to further identify what could go wrong and how to push for these more positive results.

Student engagement is highly sought after within a classroom, especially when it leads to greater achievement and learning. Inquiry-based learning has the potential to increase student engagement through its variety of options and applications. Even though planning can be time consuming and the activity can seem uncontrolled at first, teachers have the ability to guide and direct students towards the proper concept. Therefore, the positive results of critical thinking, increased achievement, better attitudes towards science, and greater student engagement all make inquiry-based learning worthwhile.

Methodology

The data for this project was collected in a fourth-grade science classroom located in a rural county. The data collected are both qualitative and quantitative, through observing students and their behaviors throughout the class periods, as well as using a pre- and post-survey. All of the students within this study were exposed to the same experiences. The lessons done for this research were focused on electricity and circuits.

The study took place over a four-day period with two fourth-grade classes. The research started with the first two days being taught with direct instruction, students took an online pre-survey of what they learned those two days, followed by two days of inquiry-based learning, and students took the same online post-survey. Both the pre- and post-survey contained three content related questions to assess knowledge and six questions related to how they felt about science class. These questions allowed me to see how their knowledge progressed from the two different

types of teaching styles and whether or not they were engaged during the class periods. Students were told to be honest in their responses and think back reflectively on what they did that day.

In addition to the surveys, I used a student engagement scale and questions each day. These included observations I made during each lesson: being on task, asking questions, thinking shown, following directions, taking notes, using proper academic vocabulary, disruptive behavior, had a positive attitude, and discussed with peers. Each day five students were chosen from each class and rated, from 1 (all the time) to 5 (none of the time) on how well they fit each description. These observations were compiled and laid out for each day, grouping strong engagement and off-task behavior, using the scale to determine the student's average rating. This rating was calculated by finding the average of all the statements scores. Each engagement scale provided feedback on how well the students were engaged throughout the lesson and used to find patterns of distinction in engagement over the four days.

On day one (direct instruction) the students were gathering their ideas about what they knew about electricity through open-ended questions, and shared these ideas with the class. After, students were informed on where electricity came from and how it ends up in our homes. On day two, an energy baton was used to lead students to think about circuits, placing students into a closed and an open circuit. Each day five students were observed in both classes and ranked on a 1-5 scale of their engagement. After these two days of instruction, students took the pre-survey to see what they knew and how they felt about the activities in class.

The next two days focused on inquiry-based learning, allowing the students to take control and explore the content being learned. Day three, student groups were given the energy batons and told to determine which materials would allow energy to flow through, creating a closed circuit. Students had to figure out a method to ensure the energy baton functioned and

determine what materials allowed the baton to work or not work; discovering conductors and insulators. Day four, the whole class was put into a closed circuit, where I provided the academic vocabulary of closed and open circuits to students. Then, students proceeded to ask questions, which we then explored as a class. The students then took the post-survey two days later, to assess their knowledge level and how they felt about the inquiry days. Again, each day I chose the same ten students to observe and rate based on their participation and engagement in class.

The project started off with the first two days of direct instruction, then students were given the pre-survey, and I completed all ten engagement scales each day. The next two days students participated in inquiry-based learning, with student-led exploration, I completed another ten engagement scales each day, and two days later students took the post-survey. Once all the data was collected, the next step was to compile the data and results. The survey questions were categorized and used to discover progression of student thinking and engagement during each lesson. Engagement scales provided further support of perceived participation levels and a survey on feelings was used to assess student enjoyment of either learning method. The final step was to analyze all the data gathered and determine if inquiry-based learning leads to greater student engagement.

Data and Analysis

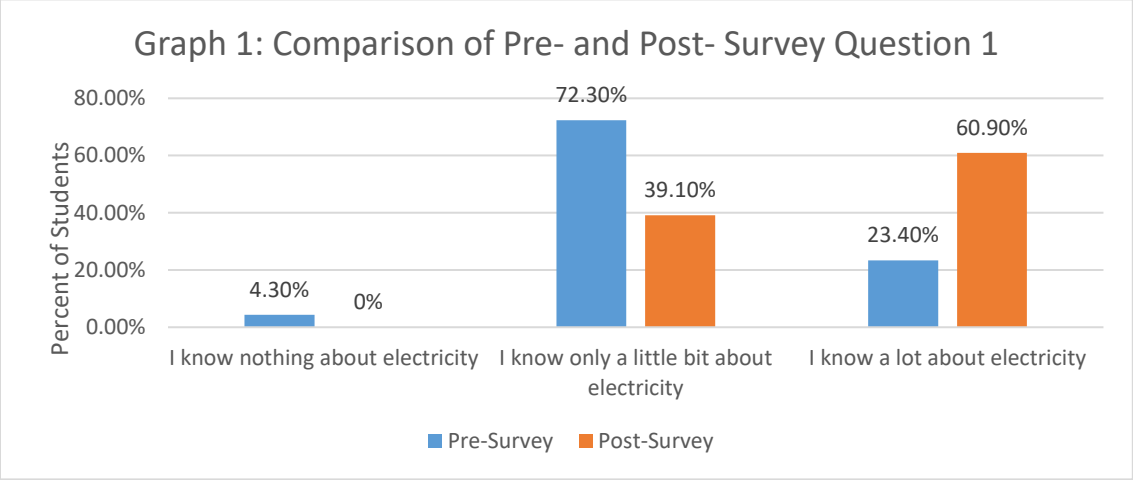
Forty-seven students took the pre-survey given after the first two days of direct instruction and the post-survey given after the two days of inquiry. There were nine questions on both, three questions on content and six questions on student feelings/engagement.

Looking at the first question for both the pre- and post-survey, students provided how they felt about their current knowledge level on electricity and there was no correct answer. Question two asked students to choose whether the picture shown, was a closed or open circuit

and students had to select one answer: closed, open, or I'm not sure. If students selected "closed" as their response, they were correct.

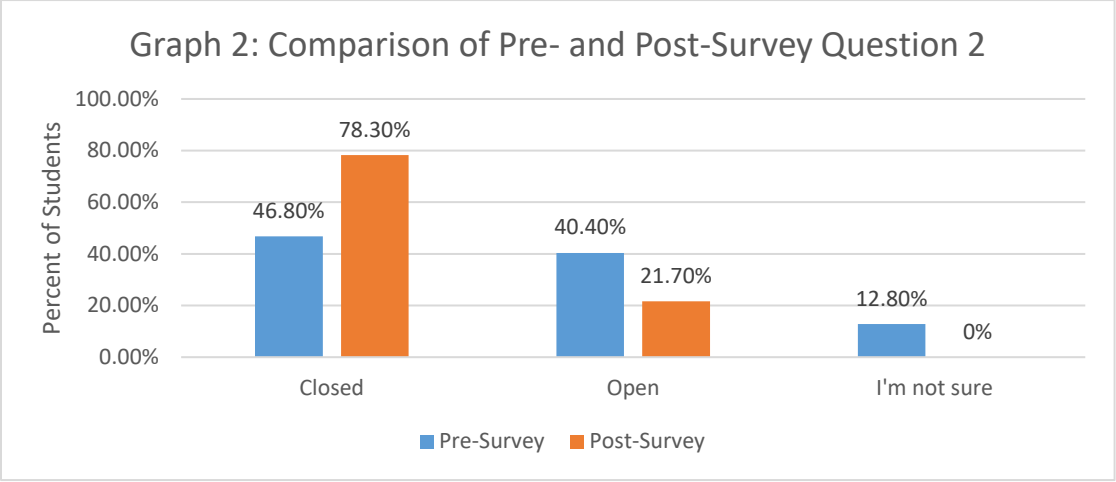
The first graph below, shows a comparison of the pre-survey and post-survey answers to question one, where students chose whether they: know nothing about electricity, only know a little bit about electricity, or know a lot about electricity. The results of the pre-survey are shown in blue and the post-survey are shown in orange. It can be seen that students at the beginning did not know as much about electricity, as there was a 37.5% increase in students who claimed to know a lot about electricity. The post-survey also shows that no students claimed to know nothing, which allows me to know that they learned about electricity through those four days.

Figure 1 Graph 1



Looking at Graph 2, a comparison of pre- and post-survey question two, the number of correct responses, went up by 31.5% from the pre-survey to the post-survey. Students seemed to have grasped what a closed and open circuit were through the two days of inquiry-based learning. Also, all students attempted to answer, without responding "I'm not sure," in the post-survey. This allowed me to see that students were becoming more familiar with circuits and how circuits work.

Figure 2 Graph 2



Question three, for both the pre- and post-survey, asked students to explain what a circuit is. For this question, I used a rubric to assign students a score of how well they expressed the content knowledge for what a circuit is. Below is a chart of the rubric used to assess each student's responses, including the criteria to meet each level.

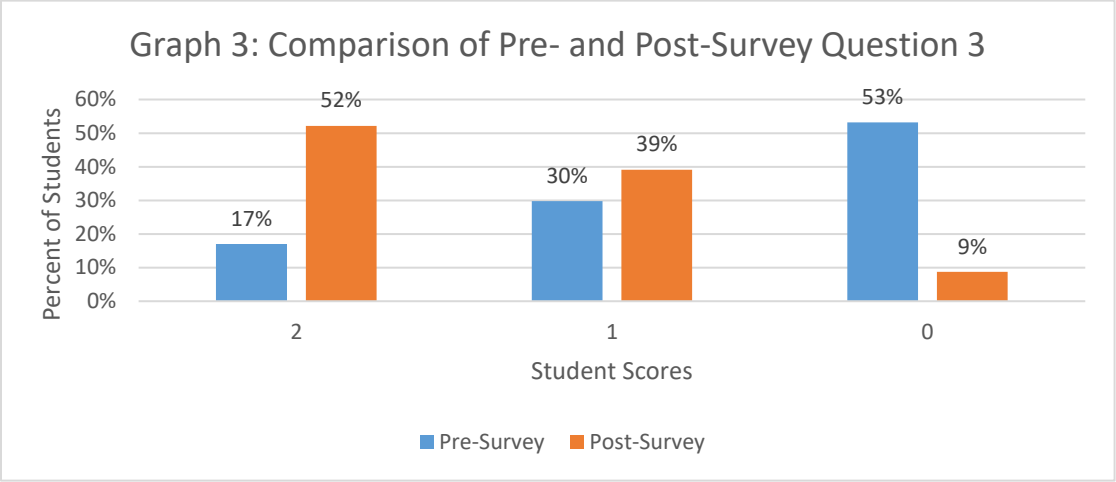
Figure 3 Rubric for Question three

Grading Scale	Criteria
2	Student gave a well-written response to earn full-credit. Looking for one of the following: • Open or closed circuit to allow electricity to flow. • Allows light bulb to turn on. • Electricity is able to flow through a path using wire.
1	Student attempted to respond to the question and discussed something that was related to electricity.
0	Student did not attempt to answer the question.

Shown in graph 3 is a comparison of the student scores for the pre-survey and post-survey of question three, displaying the percent of students that scored either a 2, 1, or 0. This

graph displays that students did better on the post-survey in receiving full-credit than they did on the pre-survey. Another detail is that most students attempted the question for the post-survey, leading me to believe that the inquiry-based instruction allowed students to feel more confident in their answers. Through each of these three questions, this allowed me to believe that students gained knowledge about electricity and that the inquiry-based learning days led students to be more successful.

Figure 4 Graph 3



Further looking at the surveys, there were six statements that students provided an agreement rating for focused around their engagement and enjoyment of science class. The ratings used were: strongly disagree, disagree, neutral, agree, or strongly agree. Pie chart 1, shows the pre-survey (left) next to post-survey (right) results, for the statement “I enjoyed class the past two days.” The results here indicate that students were more interested in the inquiry-based learning the second two days, due to 31.2% increase of students now strongly agreeing with the statement. Seeing this shift in opinion, signifies that students prefer a more interactive and student-led approach to the science classroom.

Figure 5 Pie Chart 1: Pre-Survey (left) and Post-Survey (right)

Another key statement students rated was "I stayed on task and paid attention throughout the whole class period." Shown in Pie Chart 2, pre-survey (left) and post-survey (right), students generally agreed to staying on task for both days, indicated by only minor adjustments in the percentages of each rating. From my observations, I rate this to be true, as most students were always focused on the content and following directions well throughout all four days. This indicated that students can remain on task through both direct and inquiry-based instruction.

Figure 6 Pie Chart 2: Pre-Survey (left) and Post-Survey (right)

Further reflecting on their learning, students rated the statement, "I thought about electricity a lot during class, and am curious to learn more." Pie Chart 3 contains these results, which show that students generally felt the same all four days, their agreement/disagreement remained consistent. The overall rating for all four days was strongly agree, showing that both direct instruction and inquiry-based instruction can lead students to think deeper and remain curious about what they are learning.

Figure 7 Pie Chart 3: Pre-Survey (left) and Post-Survey (right)

Finally, the last statement "my mind stayed focused on what we were learning, I never day dreamed" students rated using the same scale. Pie Chart 4 indicates that more students truly focused on the two days that were inquiry-based (post-survey right) as compared to the two days of direct instruction (pre-survey left), as shown through the 25% increase in students selecting agree or strongly agree. These results indicate that students felt they were more focused during the more interactive, inquiry-based learning days.

Figure 8 Pie Chart 4: Pre-Survey (left) and Post-Survey (right)

Another piece of data that was recorded was teacher observations of five students from each class. The chart below indicates the average score that each class received on each of the four days, along with the average of both classes for the two direct instruction days and the two inquiry-based learning days. The lower the number the better the engagement in class, as indicated by the statements rated. Looking at the results, the average for direct instruction was 2.60 which on the scale is in between "all of the time" and "sometimes"; indicating that

generally students were engaged in the lesson. The average for inquiry-based instruction was 1.81, closer to "all of the time" than the direct instruction days. These averages reveal that students were more engaged during the inquiry-based lessons; however, it is not a significant difference.

	Class A	Class B	
Day 1	2.75	2.63	**Average Direct Instruction**
Day 2	2.63	2.38	2.60
Day 3	1.75	2	**Average Inquiry-Based**
Day 4	1.75	1.75	1.81

Further compiling all the data and analyzing the results led me to comparing two of the students chosen for the engagement checklist. To choose, I selected one high student and one average student. Matthew[1] is a student who excels in science class and grasps the concepts easily, he did well on both the pre- and post-survey and showed greater signs of engagement in the inquiry-based learning days. Zack[1] is an average student who typically loses focus easily in class. He did not do well on the pre-survey, he scored well on the post-survey, and showed similar signs of engagement across all four days.

After noticing their improvement in the content knowledge, I decided to focus on their overall ratings on engagement, from their survey responses and my own observations. Starting with Matthew, his responses for the pre-survey revealed his overall engagement with the direct instruction lessons. For the statements, "I enjoyed class the past two days" and "I thought about electricity a lot during class, and am curious to learn more," Matthew rated strongly agree. For the statement, "I stayed on task and paid attention throughout the whole class period" he chose

[1] All student names have been changed to pseudonyms to keep their identity anonymous.

agree. The last statement, “My mind was always working, I never day dreamed,” Matthew selected neutral. Looking at the engagement scale completed on Matthew, his overall score was 2.25, putting him at being engaged most of the time throughout class. Based on these pre-survey results, Matthew was engaged throughout the lessons and involved in the course content, and he enjoyed those two days. On the post-survey the only change occurred on “My mind was always working, I never day dreamed” as Matthew selected strongly agree instead of neutral. His engagement scale rating also increased from 2.25 to 1.75, signifying that Matthew was more engaged in the inquiry-based lessons than he was in the direct instruction lessons.

Matthew’s responses and engagement scale ratings show a difference in engagement between the two teaching methods used. Matthew was more engaged in the inquiry-based lessons. Looking back, this could be due to the general nature of inquiry-based learning, where students have a chance to be active and move about the classroom. For Matthew, on the inquiry-based days he stayed on-task more often and had to think throughout most of class. While for direct instruction, there was less of a chance of being active.

Zack’s response to each of the statements on the pre-survey and post-survey revealed a very similar trend to Matthew. In fact, Zack’s selections were the exact same as Matthew’s for the pre-survey: strongly agreeing with enjoying class and remaining curious; agreeing with staying on task; and being neutral for his mind staying focused. The engagement scale for the direct instruction days indicated that Zack was involved most of the time, with an average of 2.38. These results suggest that Zack was actively engaged in learning those two days. Comparing the pre-survey to the post-survey, Zack changed two statements. He changed “My mind stayed focus on what we were learning, I never day dreamed” to agree (instead of neutral) and “I stayed on task and paid attention throughout the whole class period” to neutral (instead of

agree). Seeing this shift, was interesting because his engagement scale rating went up from 2.38 to 1.75. However, Zack believed that he was not paying attention as much, even though he did believe that his mind was staying focused. Overall, Zack ranked similarly with Matthew, in that his engagement increased from the direct instruction days to the inquiry-based learning days.

Further analyzing Zack's responses reveals that Zack's opinion of class appeared to remain consistent, while also gaining greater engagement in the activities. From classroom observations through the engagement scale, Zack remained on task more often, asked a lot more questions, and showed greater thinking throughout the inquiry-based learning days. However, Zack's responses do not fully reflect my own observations, which led me to believe that he may have felt differently. Nevertheless, Zack showed a large increase in engagement and enjoyment in the last two days.

Fortunately, looking at the graphs and pie charts above, through examining other student's responses and engagement scale scores, my students responded well to inquiry-based learning. Questions one through three revealed that students had a greater increase in content knowledge after the post-survey (inquiry-based learning) days. Their responses to these questions supported that students can learn through both direct instruction and inquiry-based learning; however, inquiry-based learning can lead to a better understanding. Questions four through nine and the engagement scales employed a slight increase in engagement between the two teaching styles. Overall, students showed a greater enjoyment and engagement in inquiry-based learning, as seen through the survey responses and engagement scores received. Both classes, showed greater content knowledge and engagement from the direct instruction days to the inquiry-based learning days.

Conclusions/Implications

In conclusion, the results of this action research allow me to feel that inquiry-based learning leads to better student engagement throughout a class period. Most of the students' responses on the post-survey indicate a greater grasp of the content knowledge and overall enjoyment. Further, looking at the engagement statements of the pie charts above, there was a positive shift in students strongly agreeing with being more on task, enjoying the lesson, and becoming more curious. On the engagement scales, both classes scored a better rating on the post-survey than on the pre-survey, pushing closer to "all of the time" for being engaged throughout the lessons. Finally, student scores on the content questions showed an increase in correct answers and students felt more confident that they were learning throughout the inquiry days. These pieces of evidence combined, signify that students have greater engagement throughout inquiry-based learning days as compared to traditional teaching.

Looking back at the research, there are many comparisons that can be made between my own results and the articles from the literature review. First of all, Aktamiş, Hiğde, and Özden (2016) concluded that students have a more positive view of science when taught using the inquiry-based approach. My students indicated this through their 31.2% increase in strongly agreeing with enjoying the inquiry-based learning days. Also, Matthew showed a stronger focus and curiosity during the inquiry lessons seen through his post-survey results. Further, Nick Sciullo (2017) states that traditional lecture "fails to engage fully the minds of students. Put simply, it is difficult to learn if one is not engaged" (p. 238). My students showed this trend throughout the direct instruction days, where students were off-task more often or not paying attention. Compared to the inquiry days, where students were constantly listening, talking, and working. Even indicated through the post-survey as most students received better scores than on

the pre-survey. Finally, Barron and Hammond (2008) discuss that both low-achieving and high-achieving students scored better academically after inquiry-based learning. The students' overall increase in scores from pre-survey to post-survey for this research allow me to concur with Barron and Hammond's results. All these pieces, reveal that students are more engaged throughout interactive, inquiry-based lessons.

After reviewing my data, I received the results I was hoping for, however, there were things that I could have done differently to make this action research better. One difference could be comparing two different science classes using the same content, specifically teaching one class all with direct instruction and the other all inquiry-based. This change may have allowed for a better comparison of data and student engagement. Looking back, a limitation of this study is using the same science concept in succession, which could have affected the content knowledge results. Another change would be to give a pre-survey even before the teaching begins, allowing the teacher to see all prior knowledge. For this study, this did not occur because of the curriculum being used and personal error. Looking back, it would be nice to know what my students already know to better compare the results of the different teaching styles. Lastly, if I could do this action research again I would like to include the different levels of inquiry, comparing guided inquiry to open inquiry and seeing how that affects student achievement and engagement. This particular study only showed one level of inquiry due to time constraints and my own inexperience. Therefore, I am interested to know if students were given more independence how they would be engaged throughout and if they would remain on task as often.

After setting up, gathering the data, and analyzing the results, this action research has led me to learn a lot about myself and my students. I enjoyed thinking more deeply about how the different approaches to teaching actually affect the students. I learned that with a little more

planning, students can have a much greater experience, especially when they are interacting and discovering the content themselves. My students were fully engaged and had a bunch more questions during the inquiry-based days, showing me their curiosity and ability to think beyond the standards. I also learned that if I find something that I want to try out, I can try it out. Not everything is going to be perfect, but as long as a plan is in place the results can lead to something amazing. In this instance, my students did a phenomenal job being given more independence and led me to discover that inquiry-based learning truly keeps students engaged.

Researching this topic and my overall experience, have led me to appreciate teaching science in more than one way. In my future classroom, I plan to approach science from multiple angles and instructional styles. Some of my lessons will still be direct instruction because it still can be effective. However, a good portion of my lessons will be inquiry-based learning to allow my students to have more independence and ownership of their learning. Before I can fully do this however, I plan to complete additional research on how to scaffold students to open inquiry and designing their own experiment. In doing so, my students will have a better chance of learning the content knowledge. Overall, I will continue to use inquiry-based learning because, through this research I have become more familiar with the planning involved and how it increases student engagement in science.

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Appendix A
Student Pre-Survey

Name: _____

1. How much do you know about electricity?
   a. I know nothing about electricity. b. I know only a little bit about electricity.
   c. I know a lot about electricity.
2. Is this a closed or open circuit?

a. Open b. Closed c. I'm not sure

3. Explain what a circuit is.

Tell me how you feel about the last two days of class by circling one of the choices.

4. I feel that I was able to ask a lot of questions during class.
   Strongly disagree Disagree Neutral Agree Strongly Agree
5. I enjoyed science class the past two days.
   Strongly disagree Disagree Neutral Agree Strongly Agree
6. I talked a lot with the people around me about electricity.
   Strongly disagree Disagree Neutral Agree Strongly Agree
7. I stayed on task and paid attention throughout the whole class period.
   Strongly disagree Disagree Neutral Agree Strongly Agree
8. I thought about electricity a lot during class, and am curious to learn more.
   Strongly disagree Disagree Neutral Agree Strongly Agree
9. My mind stayed focus on what we were learning, I never day dreamed.
   Strongly disagree Disagree Neutral Agree Strongly Agree

Appendix B

Student Post-Survey

Name: _____

1. How much do you know about electricity?
   a. I know nothing about electricity. b. I know only a little bit about electricity.
   c. I know a lot about electricity.
2. Is this a closed or open circuit?

a. Open b. Closed c. I'm not sure

3. Explain what a circuit is.

Tell me how you feel about the last two days of class by circling one of the choices.

4. I feel that I was able to ask a lot of questions during class.
   Strongly disagree Disagree Neutral Agree Strongly Agree
5. I enjoyed science class the past two days.
   Strongly disagree Disagree Neutral Agree Strongly Agree
6. I talked a lot with the people around me about electricity.
   Strongly disagree Disagree Neutral Agree Strongly Agree
7. I stayed on task and paid attention throughout the whole class period.
   Strongly disagree Disagree Neutral Agree Strongly Agree
8. I thought about electricity a lot during class, and am curious to learn more.
   Strongly disagree Disagree Neutral Agree Strongly Agree
9. My mind stayed focus on what we were learning, I never day dreamed.
   Strongly disagree Disagree Neutral Agree Strongly Agree

Appendix C
Engagement Scale Checklist

Mark the best response to each item.

1	2	3	4	5
All of the time		Sometimes		None of the time

- On task behavior	1	2	3	4	5
- Asking questions	1	2	3	4	5
- Thinking shown	1	2	3	4	5
- Following directions	1	2	3	4	5
- Using proper academic vocabulary	1	2	3	4	5
- Disruptive behavior	1	2	3	4	5
- Has a positive attitude	1	2	3	4	5
- Discussed with peers	1	2	3	4	5