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Engagement in Science Instruction in a First-Grade Classroom

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Abstract

Too often, science is pushed toward the bottom of the priority list when it comes to teaching in elementary schools. Focusing on student and teacher perceptions, the researcher of this study wanted to know how this theme or attitude would shift if science became a higher priority in the classroom, for both students and teachers. What do students see as the most important when it comes to engagement and construction of their own learning in science instruction using the Science by Month curriculum? Data was collected for five weeks through student and teacher surveys, interviews, and observations. The constant comparative method was used to analyze the data, along with level I and level II coding. The findings pointed toward the importance of connections, community, intentional time, access to real things, and opportunities for student ownership. There was an overall attitude of positivity found toward the engagement and mastery of content by both students and teacher.

Engagement in Science Instruction in a 1st Grade Classroom

"Science was always – science and social studies were like the stepchildren of subjects. Sometimes they got paid attention to, sometimes they didn't. … Science, this year has really been fun, especially because… we made time for it." Mrs. Long (all names are pseudonyms), the classroom teacher during this study, stated this during her interview. Throughout placements in a variety of schools and grades, I noticed this "stepchildren" trend in relation to science and social studies. With the implementation of a new science curriculum recommended by a teacher who recently moved to Lopez Elementary, I wanted to take the opportunity to see what students and teachers thought about the subject in general, as well as this new curriculum. While I understood the importance of reading and mathematics as a priority, I was curious why science in particular seemed so unimportant. This curiosity was fueled further after I began using the Science by Month curriculum with first graders. I personally found science to be a favorite part of the school day. Reflecting on my own perspective, I decided to gain the perspectives of my co-teacher and students in order to better understand this "stepchildren" dilemma.

Purpose

The purpose of this study was to gain understanding of student and teacher perceptions of engagement and mastery of content in science instruction through the first-grade Science by Month curriculum. This curriculum, written by teachers and based on the Common Core Standards, was shared with the first-grade team at the beginning of the year by another teacher who had discovered it while at a previous school. Science by Month focused on the hands-on learning of science content. Students across the spectrum of academic achievement, as well as the teacher were surveyed, interviewed, and observed in hopes of understanding the most valued aspects of science instruction that promote deeper engagement. As well as engagement, my study also focused on perceptions of mastery of content and the integration of academic subjects. My research questions consisted of the following: What are the teacher and students' perceptions of Science by Month science instruction in a first-grade classroom?

Sub-question 1: In what ways does the teacher feel that this program helps the students master the science content and engagement?

Sub-question 2: How do the students perceive their mastery of science content and engagement through this program?

At the time of this study, I was completing a fifth-year master's degree in teaching and learning. As a part of this degree I was required to complete a year of clinical teaching in one continuous placement. This study was conducted in my given placement with my co-teacher and first-grade students at Lopez Elementary. Lopez Elementary is a Title I school, as well as the only bilingual elementary campus in the district, with approximately 650 students in grades K-5. Approximately 90% of the campus is economically disadvantaged, and approximately 25% of the student body are English Language Learners.

Related Literature

Too often, science is pushed toward the bottom of the priority list when it comes to teaching in elementary schools. Many teachers are happy to simply get to science, even if it is not a full lesson. Reading instruction is seen as a top priority, specifically in the younger grades (Miller, 2008). I wanted to know how this theme or attitude would shift if science became a higher priority in the classroom, for both students and teachers. Research suggests that the level of engagement leads to the level of achievement. This means that knowing how to engage students by understanding what is important to them can have great impacts on achievement (Fredricks, Blumenfeld, & Paris, 2004). Milner, Templin, and Czerniak (2011) researched student perceptions of motivation and engagement when learning in a life laboratory versus a traditional classroom. Students were taught in both settings, a laboratory near the school that was designed for authentic engagement with science topics, as well as a traditional classroom setting. This study showed that motivation increases when students are able to learn through authentic contexts and are allowed to construct their own learning, relating directly to Piaget's theory of constructivism (as cited in Kohler, 2008). Grabau and Ma (2017) conducted a quantitative study which analyzed nine different aspects of science engagement as predictors of achievement in science. An overall positive relationship was found between these aspects of engagement and predictors of achievement.

Researchers have also studied the importance of integrating various academic areas into the sciences. English (2017) explained a variety of perspectives on four different issues related to STEM education. One of these hot topic issues is how STEM integrates different academic subjects together, as well as the effects of this integration on education. Olivera (2015) conducted a study on engagement of reading within science instruction, specifically looking at the difference between transmission and transaction. The study, relating directly to Rosenblatt's (2005) transactional theory, found that the more transactional the read alouds, the further depth in integrating reading into science.

Engagement is believed to be the foundation of learning by many theorists and researchers, including Piaget (as cited in Kohler, 2008). As I familiarized myself with background knowledge of this topic and what has been previously studied, I began to notice that the theme of self-efficacy was woven through many studies with a focus on engagement. These various studies showed the self-efficacy of students coming into a classroom, as well as the impact of teachers' self-efficacies on students, were found to be strong factors contributing to the level of engagement. Jaber and Hammer (2016) conducted a study concerning engagement in science education. The study specifically focused on the epistemic effect, which is defined as, "…feelings and emotions experienced within science, such as the excitement of having a new idea or irritation at an inconsistency" (p. 189). The researchers argued that these feelings and emotions of being a scientist are vitally important to the engagement of students in science education. Miller, Curwen, White-Smith, and Calfee (2015) conducted an implementation study focused on professional development for science instruction as a response to teachers having a lack of preparation and professional development opportunities, which lead to a lack of confidence and belief in themselves. The findings were, that when given time as well as resources of content knowledge, teachers thrived in science instruction. In turn, their students also thrived. Sakiz (2015) researched the connections between the students' perceptions of the teacher's support and mastery orientation, along with the students' own emotional and motivational factors and the effect on their academic achievement in science. The study found that the most important link was seen between a student's original sense of self-efficacy and behavioral engagement. The findings also showed that there was a positive relationship between a teacher's support and a mastery orientated classroom environment, and the students' academic achievement and behavioral engagement.

The study that I have conducted draws from many theories and areas of research that have been foundational in understanding how children learn. This study is influential personally by giving me perspectives on how my students learn and engage deeply in their science instruction. Student voice is one the most important aspects that this study brings to the educational community of research. I wanted to know what about science instruction did the students find the most engaging and meaningful. What did the students see as the most important when it came to constructing their own understanding in science instruction? Along with engagement, the study that I conducted sought perspectives on mastery of science content. I was interested to see the perspectives of students on the integration in science of reading as well as other subject areas through my study. While there have been studies researching similar perceptions, my study combined many of these topics into one. My study also simply adds more student voices to the body of research in the educational community. These voices should be some of the most important voices in educational research, because these voices are of the students being taught. The more voices and perspectives heard, the clearer the picture of how to teach these individuals becomes.

What I Did

Engagement can be broken up into three types: behavioral, emotional, and cognitive (Fredricks et al., 2004). Knowing this shaped how I collected my data, particularly in terms of what I looked for in my observations. Using three different types of data collection, I studied how my students and cooperating teacher interacted with the science curriculum being used in the classroom.

Participant Selection and Data Collection

The participants in this study included a single classroom of first-grade students and one classroom teacher. An information letter and an attached consent form was sent home to the parent or guardian of every student in the class. The students receiving parental permission to participate in the study completed an assent form while at school. Of the sixteen students in the class, all who received parent permission and assented to the study were given a student survey on the perceptions of science instruction. I chose a sample of students to interview based on their overall academic level. I selected two students who were high performing, two students who were middle performing, and two students who were low performing. I chose a sample of students that represented the makeup of my class. It was not necessary to interview the entire group, as I was able to get a representative sample by interviewing six students. My interviews were one-on-one interviews, and each student selected was interviewed once.

An information letter and an attached consent form was also provided to the classroom teacher. After giving consent, she was given a survey to complete, also on the perceptions of science instruction. I also conducted one interview with the classroom teacher, using the previously given survey as baseline guide. Student and teacher interviews were conducted following the classroom observations.

These three forms of data collection used together gave me full picture of student and teacher perceptions. Each survey consisted of five and seven questions and focused on engagement and overall attitude toward curriculum. The questions were based on the Likert Scale. Each survey is included in the appendices following the conclusion. I also conducted full observations two times per week for a period of three weeks. I observed all students who assented and had consent, as well as the classroom teacher. The observations took place during science instruction looking for specific examples of engagement such as the following: on-task and off-task behavior, depth of questioning, etc. Each observation lasted the length of science instruction for the day, roughly forty-five minutes. The last form of data collection was in the form of interviews. I interviewed Mrs. Lantrip for thirty minutes one time. I interviewed six consenting students one time for ten minutes each. The question format for interviews was open-ended in order to give space for participants to discuss what they deemed to be the most important aspects of this topic (Hendricks, 2017).

Data Analysis

To analyze data collected, the constant comparative method was utilized as it provides a means to discover themes in the data. The interviews and observations were then coded using hierarchies of categories and supporting codes (Hubbard & Power, 2003). I analyzed the surveys to look for themes as well. The data from the surveys and observations pointed me toward more data to look for during the interview process. Initially, the first 20% of the data was analyzed by looking for 15 to 20 level I codes. I then used those 15 to 20 codes to code the remaining 80% of the data. The level I codes were common themes or word for word phases that stuck out in the data. Following this round of analysis, I categorized the data into five level II codes that were based on the level I codes. The process worked out so that all my level I codes were assigned as sub codes underneath the five level II codes. As a part of level II coding analysis, memos reflecting on each of the five codes were written (Tracy, 2013). To organize my codes, I created a codebook which defined and gave examples of the level I and level II codes. This codebook can be found in Appendix A.

What I Found

Something that I noticed while analyzing is that it became difficult to break the data up into different codes at times, particularly when it came to making level II codes with sub-codes underneath. I found that this was because the data had multiple meanings that answered my research questions in many different ways. While there were a few distinct findings, many codes and themes overlapped into one another. There were many aspects feeding off of each other to result in meaningful engagement and memorable learning for the students. I found that these levels of engagement and mastery of content depended less on this particular curriculum and more on the key characteristics that it provided to the classroom. Understanding these different key characteristics significantly informs my teaching in not only science, but also in other subjects in order to promote further engagement and mastery of content. The findings below are sectioned by the five level II code names.

Connections and "Flow"

Many of the findings related to this code were encouraging to me as a teacher because I found there were perceptions of high levels of student engagement with the learning itself, rather than a majority of student engagement being based on a lesson's perceived amount of fun. In other words, the perceptions in the data pointed to a love of learning. This balance between depth of learning and fun is very difficult to find at times, and it was encouraging to see that the way we were teaching this curriculum helped us find this balance. The implications to finding the balance between meaningful learning and play are in the specific as well as general aspects of the Science by Month curriculum. Specific activities, experiments, and lessons seemed to greatly lead to a perception of high engagement and mastery of content. However, there were also general ways to teaching that were woven into how this curriculum was written that seemed to have the same affect. For example, one general aspect of the curriculum was the connection between subjects that allowed a steady rhythm, or flow, to characterize learning in our classroom throughout our day.

Connections and "flow" is a level II code specifically focused on how students related their learning during science instruction to other subjects, other experience in the classroom, other parts of their cultures or lives, etc. Throughout interviews and observations there was an overall positive attitude toward the idea of connections leading to meaningful learning, and then meaningful learning leading to connections. It became a cycle. Seeing this play out in science instruction excited Mrs. Long. During her teacher interview she stated, "That's one of our goals – always to make connections with either anything else in the classroom, and then into real life."

Later in the interview, Mrs. Long discussed her perspective of teaching science in previous years. One point that she brought up was, even when science instruction had the potential to be highly engaging, there was a complete lack of connection to the remainder of the day in the classroom. Mrs. Long perceived this integration of subjects to be a crucial factor in the engagement and mastery of content for students.

After finding the level I codes, I thought that “meaningful” learning would end up under a different level II code. However, as I got further and further into the next step of the analysis, I began to realize that the data falling into the “meaningful” learning code fit much better with data in the connections and daily “flow” sub-code. These two sub-codes along with theme weeks, and books and videos ended up becoming the level II code named, connections and “flow.” While this code only had four sub-codes, it ended up having the second most amount of data collected under it. Theme weeks, as well as books and videos are relatively self-explanatory codes. The science curriculum used in this classroom was planned in weekly units by theme. Many of these themes correlated with the reading curriculum being used, in part because the authors of the curriculums were the same. Videos were used in many weekly units to supplement learning. One interesting thing that I noticed about theme weeks, is that several students hadn’t realized that we had planned weeks by theme on purpose. There were a few ah-ha moments when this realization hit.

There were some particular areas of connection that I was extra curious about gaining the teacher and students perspectives on. As I stated above, the authors of the Science by Month curriculum are the same authors of the guided reading curriculum that we used in our classroom. This meant that there was an intentional integration between subjects from the beginning. I wanted to know how the students and teacher felt about this flow during our day of learning.

While many of the students did not realize the intentionality of the integration, they were still constantly making connections. A majority of the students that were interviewed mentioned books from our reading curriculum before I even asked about them. Interestingly, some of the students seemed almost indifferent to how we planned the themes and connections, but showed great enthusiasm toward the activities themselves. They even excitedly began making connections throughout the day on their own.

The other area of great interest to me when it came to connections was the subject of writing. Writing was a challenge for many of our students, and just not a favorite of several others. Throughout student interviews, there was a mixture of perspectives of writing that averaged out toward a neutral of negative feeling. However, throughout observations, I began to see an increase in participation when it came to writing during science. During many lessons the students were given a choice of writing or drawing to record data. Other lessons would be structured as a group write, in which the students and teacher would write the same things together to record data. Some lessons would include a requirement of independent writing with words instead of drawings. As observations continued I began to see a greater attention to detail in writing and drawing. Figure 1 and Figure 2 show examples of two students' writing after I began noticing this positive change.

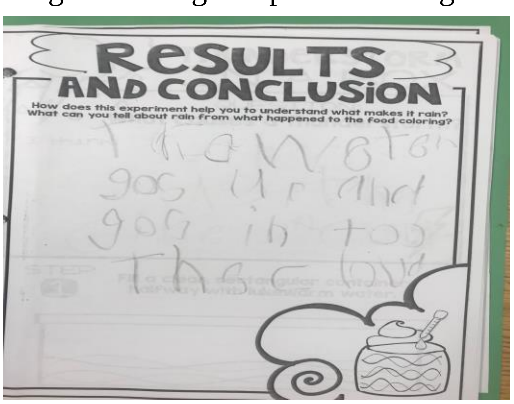

Figure 1. Recording page for the rain in a jar experiment.

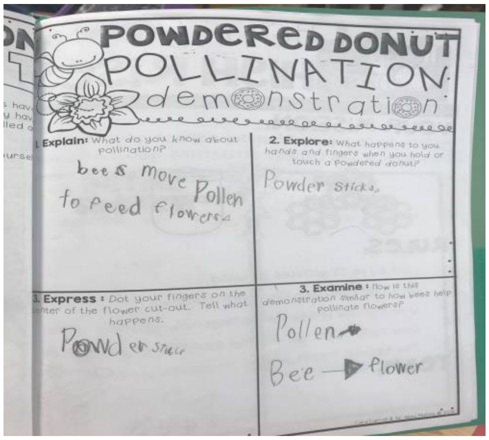

Figure 2. Recording page for Powdered Donut Pollination investigation.

Connections and daily “flow”, as a sub-code, includes data focused on connections between subjects and times of day, as well as connections to everyday life and the world around them. As I would say to my students, it made my heart happy to see how much data ended up being coded into the “meaningful” learning sub-code. This code included observations of questioning, clarifying, teacher support through a gradual release of responsibility, teacher modeling, problem solving, student observations, and other student centered learning moments. Based on the data, I believe that these codes and findings ended up running together because deep and meaningful learning happens when there is a continual flow of connection that allows the brain to solidify the concepts and content. This idea leads directly into my next finding, which focuses on the opportunities to interact with real items and materials.

“We Always Get to Do Stuff”

This code was an invivo code from an interview with a student who is low in overall academic achievement. It seems to me that the invivo codes, such as this one, hold a lot of power in speaking to the question of engagement with the learning. Mrs. Long mentioned in her interview that the curriculum used in this classroom was challenging. That did not stop students of all levels of academic achievement from having positive attitudes toward participation and mastery of content. Mrs. Long discussed her perspective of students' mastery and participation when talking about the flow of the science lessons by saying, "They have to know the vocabulary in order to do the pre-activity with a hypothesis and a prediction and everything. And then they have to apply what they know with their experimenting. And then, they go back – oh this is then the conclusion. What did I do? What could I have done different? And they really are excited about the whole process."

The three sub-codes that made up this main finding all focused on the hands on aspects of science that stuck out in students' memories. An interesting thing that I noticed kept appearing in student interviews was the direct mentioning of "real things." This speaks to so much research that has already been done on realia. It was noteworthy to see that a majority of the memorable experiments recalled specifically by the students involved direct engagement with real life materials through activities and experiments. Some of the specific experiments and activities recalled by the students were making a cloud, watching warm air expand with a balloon and a bottle, primary colors investigations, what's in the bag from candy week, and five senses investigations such as blindfolded drawing. A particularly interesting finding to me was that the memorable experiments were split fairly evenly in terms of whether the students were hands on themselves, or observing a whole group experimental demonstration. All of the memorable experiments included realia. I included a picture of one of these memorable experimental demonstrations in Figure 3. An unexpected addition to the mentioning of activities and experiments was that of games. I had not anticipated this one being brought up by the students or the teacher as much as it was. The implication for this finding in terms of immediately informing science instruction in this classroom was that the vocabulary games as well as other games were not something to pass over, but intentionally added to the students' engagement.

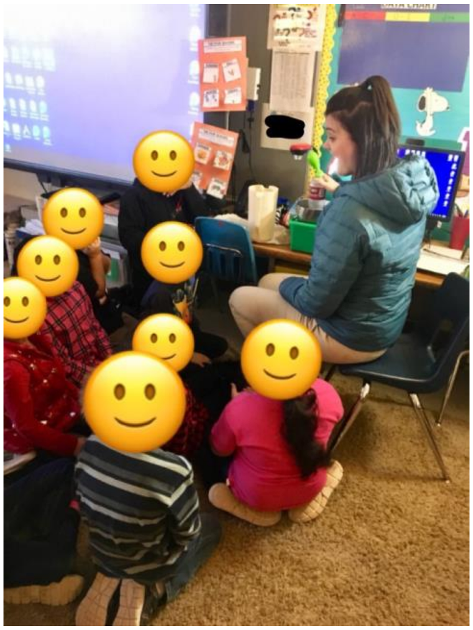

Figure 3. Photograph of myself demonstrating how air expanding when heated, using a bottle and a balloon.

During her interview Mrs. Long stated, “They are able to learn and retain the knowledge that they’re doing and what’s going on in the world around them, because that’s what science is.” The root of the subject of science is what goes on in real life. It was not surprising to me to find that the students perceived themselves fully engaged and learning a lot, because they were learning about real concepts with real materials. There are some topics that seem difficult to add real things into, but I believe that I can only expect my students to put in as much creative thinking as I am willing to.

“The People”

This code was one of my personal favorites, probably because it is all about community. The invivo code of “the people” came from a student interview. The invivo sub-code of “allows for individuality” came from the teacher interview. This main level II code is focused on instances and perspectives on socialization and cooperation, as well as the opportunities for students to learn at their individual developmental level. Mrs. Long stated in her interview, “My favorite is watching them – watching and listening, being a fly on the wall. Um, any type of group work with kids where the teacher is not actively involved in the group, I think the list of positives grows for that tremendously. You know, all the way back to, they're socializing. They need to learn to socialize with the group and then work together." Through this interview I found a teacher perspective of the importance of the students working together, instead of being dependent on the teacher, in order to foster greater mastery of content. "Allows for individuality" includes data on use of prior knowledge, as well as any predicting. This sub-code also includes data on how student ownership plays out during science in this classroom. These more easily found opportunities to differentiate through this curriculum allow for natural ways in which students are encouraged to take further and further ownership of their own learning. There is space for the teacher to follow the gradual release of responsibility with students, despite them each being on different readiness levels.

"The people" as a sub-code also shows many data that are related to students sharing in learning together. This took many forms, such as students encouraging one another in their unique strengths, and students enjoying hearing and sharing the different ways people see and go about various problems. I was happily surprised to find through interviews how many students enjoy seeking and understanding the perspectives of others. Any way that I can naturally encourage this action of understanding other people is a win for me as a teacher. This sub-code also noted the varying preferences in whole group activities versus small group activities. The implication for these perspectives can help me understand different personalities of children in general, as well as help me plan for this class specifically in a way that regularly engages each of my students. With this class in particular, there was an importance to me in encouraging positive socialization skills due to the level of difficult behaviors that required management and damage control daily.

“Learning is Noisy”

There were eight different level I codes that ended up fitting into this level II code, making this the finding with the most sub-codes under a level II code of all five main codes. Everything under this code had to do with visible and auditory engagement during science. To name this code, I chose to use a level I code that I named, “learning is noisy” after a quote from the teacher interview, “You just can’t have a quiet science. You know, learning is noisy.” I loved this quote and felt that it summarized much of what I saw and heard within science in this classroom. I chose to add the sub-code, pride in knowledge, under this code. I did this because the students wanting to share what they had learned was seen with excitement, and it pointed to one way students engaged with their learning. I chose to add the sub-code, exciting and different, under this code because it spoke to how students and the teacher engaged in this science curriculum either more often or with greater depth than curriculums used in previous years. The student surveys (see Appendix B) as well as the interviews pointed toward a lack of remembering science from previous years. The science that was recalled consisted of certain hands on experiments. This tells me that the most memorable learning to the students involved hands on activities, experiments, investigations, and demonstrations.

My findings for this code were very exciting and hopeful for me as a teacher. Being able to listen to the students and teacher about what they enjoy was just fun, because there was so much that they wanted to share about what they enjoy. One of the most hopeful sub-codes that I noticed in my analysis was positive behavior. We had some very difficult behaviors in our classroom that required constant management and damage-control throughout the day. Looking back through the analysis of this code I noticed that there were significantly less difficult behaviors during science time. To see not only this decrease, but also a replacement of more positive behaviors in our most challenging students, was more than I expected. For example, I have written in an observation, "Kevin sat scowling at first but soon broke into a smile when beginning to participate with group in activity." There were still negative behaviors present, but I did notice that there was a markedly more negative reaction to the consequence of not being able to participate. This showed a significant motivator in the self-control and awareness of the students who had difficulty in this area. Mrs. Long noticed this as well and brought it up in her interview saying, "I think that if they are not allowed to participate, they're frustrated. And when we even heard our boys that in their little cubicles, they were participating in science yesterday. Not physically, but verbally. I could hear them participating by answering something that another child raised their hand to answer."

"Jumpstarted" the Priority

The fifth and final level II code was made up of three sub-codes, all of which came from the interview conducted with the classroom teacher. I chose to name the level II code after the level I code, "jumpstarted" the priority, because there was a sense of excited urgency in the wording. This importance and eagerness that is felt and found in the data organized under these codes is represented well by this overall terminology. The sub-code named "jumpstarted" the priority is mostly full of data pertaining to the teacher's sense of renewal in finding less time consuming, but still fully engaging ways to plan and instruct science regularly in the classroom. Setting a priority to get to science roughly four times per week has increased the importance of science that is felt in the classroom. Mrs. Long stated, "But we've really made a point to make time for science, because of how important and fun it is this year. … So, I think the want-to has risen dramatically." The sub-code named, structured and organized is a connected code due to the amount of things that have to get done every day. Mrs. Long admitted that if there is not enough structure and organization, the priority of science will still not fit in the learning day regularly. "Teacher want-to" is a connected code related to the urgency discussed earlier, but focused on how the teacher engages with the curriculum content, as well as with the students.

Many of the same kinds of anticipation and excitement seen with the students, was seen in the teacher as well. "I'm like the kids. I wanna see! I wanna see! I wanna do it! I want to participate in what they're doing to. But, and when I teach it, I just kind of get into it too. I get so excited, and I think my voice level raises." Findings also pointed to the impact that genuine teacher engagement has on student engagement. Mrs. Long discussed this in full stating, "Oh, it's the biggest part! If you don't want to do it, they're not gonna want to do it. If you're excited about it, they're gonna be excited about it."

One finding that I did not necessarily expect was how often the students pointed to various structures and organizational systems that they saw as important. A significant implication for this finding was being able to note the structures that promote student success in learning while still allowing for student independence and ownership. As noticed in other codes and findings, there is an important balance that can be tricky to find. The value that this data and research holds is seen in how hearing the voices of the students allows teachers to be aware of specific things that help the classroom work in a collaborative way, in order to find the balance more often.

Implications

For this research project, I wanted to focus on gaining understanding through the perceptions and perspectives of my co-teacher and our first-grade students regarding engagement levels and mastery of content in our classroom science instruction. The findings for this study were broken into five level II codes: Connections and “Flow”, “We Always Get to Do Stuff”, “The People”, “Learning is Noisy”, and “Jumpstarted” the Priority. While these codes were separated through their focuses, they all wove together seamlessly. The students and teacher showed an overall positive response to the Science by Month curriculum being used in our classroom. This positivity, along with hands on materials, stirred engagement, leading to an increase of priority, a decrease in negative classroom behaviors with a replacement of positive participation, and a greater depth of learning through student ownership and socialization.

One of the most immediate implications this research personally had on me was reflecting on how each individual student feels that he or she learns best. I am a firm believer that knowing my students’ strengths and weaknesses well is a requirement to be able to teach them well. Some of the findings with certain students were things that I already knew, but others were new to me. This affirmed my goal in teaching every subject to place a priority on getting to know my students as learners and people. Along with this affirmation, one of the other main takeaways to inform my own teaching in the future was that of the crucial importance of dedicating planned time for science instruction. Throughout her interview, Mrs. Long kept coming back to the idea of making time for the instruction. Without this intentionality in the beginning the hands on and engaging activities would not have mattered because there would not have been time to try them.

For teachers who have also noticed this trend of science being a stepchild of subjects and want to change that but don’t know how, I would offer three main pieces of advice and one overall encouragement. First, know that, as in all other areas of teaching, it will differ from class to class and student to student. As with all good teaching, begin by getting to know your students. Secondly, a decision must be made about where science instruction will fall on your priority list. Personally, I can tell you from this year that the priority may fluctuate throughout the crazier seasons of the year. However, there needs to be a general area of priority for it to work. Third, findings showed that the memorable experiments involved using hands on materials as a classroom community in some way. This can take so many different forms. Find what fits with your classroom. My encouragement is this: while it may seem daunting to add such a big piece to your classroom, the time and effort it takes will be worth it in full. The excitement that comes from the students and teacher being equally engaged in the learning process is infectious. Science quickly became the favorite for all in our classroom.

The last, but certainly not least, implication for this research was the value placed on each voice being intentionally heard. For the students, this teaches that they have a voice in their education, which allows for a deeper level of learning, as well as an opportunity to take ownership and practice responsibility. These voices should be some of the most important voices in educational research, because these voices are of the students being taught. The more voices and perspectives heard, the clearer the picture of how to teach these individuals becomes.

As the findings emerged in the study, I realized that it could be broken down into so many different, more specific areas of focus. Each of the five major findings could become its own small future study. How does the integration of subjects, such as reading and science, affect mastery of content? Do different kinds of realia affect engagement in science instruction differently? How does socialization play a role in the engagement and mastery of content in first-grade science instruction? How does the balance between structure and chaos play a role in the engagement of first-graders in science instruction? What specific aspects of this way of teaching science cause the rise in priority? I think that recalling these findings and asking these further questions will encourage deep and meaningfully engaging learning across subject areas.

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Appendix A

Codebook

Code Name	***Level***	***Definition***	***Example***
"Jumpstarted" the Priority	1	Reasons for and ways of making time and space for science	"But we've really made a point to make time for science, because of how important and fun it is this year."
"Teacher Want-To"	1	Engagement, conversation, and enthusiasm shown by the teacher	"I want to participate in what they're doing."
Structured and Organized	1	Classroom management, planning, and scheduling	"You know, once its sorted and planned, it's not hard at all."
"Engaging and Exciting"	1	Evidence of engagement with the learning by the students and that teacher	"Some partners being listened to – open mouthed when listening to how high partner is counting."
Positive Behavior	1	Attitudes and behaviors expressing positive classroom engagement	"Kevin became more talkative as he kept going."
"See What Happens"	1	The anticipation of participating and observing	"JJ – reminding that she said they were going to make a stethoscope."
"Exciting and Different"	1	Ways this science compares or contrasts with previous experiences	"Whereas this one offers them, suggests them, gives you clips, books, everything, and then makes it easy to go on."
"Learning is Noisy"	1	Verbal engagement within the learning of science	"There is an excited atmosphere. Students are talkative."
Pride in Knowledge	1	Students showing the knowledge they have gained with confidence and enthusiasm	"Kevin carefully brings the house he made over to show me. 'LOOK! I made a house!!'"

“I Feel Good”	1	Students expression of conscious perspectives	“That’s just my favorite, and I still like the rest of them.”
Open-Mouthed and Wide-Eyed	1	Students’ physical expressions of engagement and reactions toward learning	“Several sitting with mouths open – completely engaged. Almost mesmerized.”
“The People”	1	The socialization and cooperative learning pieces of science	“Conversations heard in all groups – all on topic, working together to measure structures.”
“Allows for Individuality”	1	Opportunities for student ownership and differentiation	“Fast finishers who can write by themselves sitting quietly, patiently waiting – eyes on screen.”
“We Always Get to Do Stuff”	1	Hands on experience with realia	“Cause we always do science to learn about things.”
Activities, Experiments, and Games	1	Interactions with the planned activities, experiments, and games	“They always have some sort of fun activity for vocabulary, and then go on into, I think, experiments.”
Memorable Experiments	1	Favorite experiments that were recalled without direct prompting	“Especially the latest one we did with teeth.”
“Meaningful” Learning	1	Opportunities for student centered learning through a gradual release of responsibility	“Is the side of your heart really blue?”
Theme Weeks	1	Anytime themes in learning material is mentioned	“Yes. I think that was – I think I sort of called that teeth week.”
Books and Videos	1	Anytime books or videos are mentioned	“Um, I feel like the book is like the thing – it gives me a hint of what we’re doing.”
Connections and	1	Connections made	“It’s kind of like a

Daily "Flow"		between any part of the rest of the day, or life outside the classroom	mail man because it leaves and come back."
Connections and "Flow"	2	Engagement rooted in meaningful learning and connection	"That's one of our goals – always to make connections with either anything else in the classroom, and then into real life."
"We Always Get to Do Stuff"	2	Hands on aspects of learning	"My best part is when, like, um, when we are like doing something with a real thing."
"The People"	2	Opportunities for socialization, student ownership, and differentiation	"Oh, the small groups! Cause then we can tell people how we've done it."
"Learning is Noisy"	2	Observable signs of engagement through attitudes and reactions	"They get excited – physically, emotionally, visibly – they're all excited."
"Jumpstarted" the Priority	2	Aspects of behind the scenes work/planning	"And now that we've made time for it, and then made this special effort with our new curriculum and everything, it's just joined right in."

Appendix B

Student Survey

1. How do you feel about science instruction in our classroom?

2. How do you feel when what we are doing in science connects with what we are doing in other subjects?

3. How do you feel about how much you are/have been learning in science this year?

4. How do you feel about the books we read during science in our classroom?

5. How do you feel about the experiments, activities, and investigations we do in science in our classroom?



6. How do you feel about when we write about what we have learned in science?



7. What is your favorite part of science in our classroom?

8. What was science like in kindergarten last year?

Quantitative Survey Data

	Loved	***Neutral/Liked***	***Disliked***
Question 1:	62.5%	31.25%	6.25%
Question 2:	50%	37.5%	12.5%
Question 3:	75%	12.5%	12.5%
Question 4:	62.5%	31.25%	6.25%
Question 5:	68.75%	31.25%	0%
Question 6:	50%	37.5%	12.5%