Investigating the Responses of Children in First Grade Engaged in STEM Lessons

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STEM education in the early childhood grades is continuing to evolve. This study investigated the responses of children in first grade when they were engaged in STEM lessons throughout one school year. Qualitative data were collected from one classroom of eighteen children and one classroom teacher extracted from student and teacher artifacts, field observations, and teacher interviews. Findings yielded three themes that described how children responded. Results suggested children responded with a value of collaboration, an application of critical thinking, and positive dispositional characteristics. Conclusions suggested engaging children in STEM lessons in early grades, especially when implementing developmentally appropriate practices such as play, may encourage growth in skills aligned with 21st century learning. The results of this study may provide information that could enhance discussions on student learning and pedagogy of strategies in STEM education in early childhood. Information may be provided that could aid in designing curriculum to deepen children's thinking skills, encourage cooperative learning, and develop social skills.

Keywords: STEM, elementary science, early childhood, engineering design

Science Technology Engineering and Mathematics (STEM) education continues to be a high priority initiative (Moore et al., 2014; STEM Education Coalition, 2016). STEM education involves the interdisciplinary application of multiple disciplines, particularly science, technology, engineering, and mathematics, to solve problems and conceptually understand the world. A common practice within STEM curriculum is the understanding of the engineering design process. This typically includes defining a problem, brainstorming ideas to solve this problem and choosing the best design, testing the design, and making improvements and retesting the improved design (Capobian et al., 2013). The integration of STEM education provides an opportunity to inspire collaboration, critical thinking, creativity, and communication, what are commonly known as the 4 C's within 21st century learning (Partnership for 21st Century Learning, 2017). The National Science Teaching Association (NSTA) (2020) encourages current STEM initiatives to be inclusive from preschool through high school and beyond.

Literature Review

Developmentally appropriate practices in early childhood grades encourage children to be actively engaged in the curriculum, in their experiences, and with each other in environments structured to allow for exploration and play (Copple & Bredekamp, 2009). The theory of play within the learning environment is more often a common practice at the preschool level but has been diminished as children move into the early grades with the focus on high stakes testing readiness (Gray, 2011; Miller & Almon, 2009; Zosh et al., 2022). Play can encourage development of children's social, cognitive, linguistic, and self-regulating skills (Copple & Bredekamp, 2009; Gray, 2011, NAEYC, 2020). Many educators will choose play-based learning approaches ranging from self-directed play to guided play (NAEYC, 2020). Self-directed play is child initiated, and guided play is where the teacher has certain learning goals in mind and guides the children towards the learning goal while they are engaged in meaningful play (NAEYC, 2020).

Play encourages rich learning experiences across academic disciplines (Minahan et al., 2021; NAEYC, 2020; Zosh et al., 2022). When children are given opportunities and time to productively play with a purpose, such as in lessons designed to integrate STEM education, they are provided with experiences to become collaborative, autonomous, and creative problem-solvers, which leads them toward a deeper conceptual understanding. STEM in early grades can be conducive to integrating other types of play, such as cross-area play where children use materials from multiple areas in the classroom, leading to cross-disciplinary experiences, that encourage limitless imagination in a self-directed manner (Minahan et al., 2021). The freedom in a cross-area approach to play evolves learning towards an intricate web of connections of developmental disciplines through the engagement of materials and unstructured lessons. Educators have found cross-area play to increase creativity, problem solving, persistence, collaboration, and student confidence (Minahan et al., 2021).

Many STEM initiatives are implemented at the middle and high school grades, and STEM research in early childhood grades is constantly growing. Research has shown the importance of STEM lessons at the elementary level to be critical for developing essential skills (Blank & Lynch, 2018; Linder et al., 2016) and a strong foundation for 21st-century learning (Brown, 2012). Early learners have the ability to conceptually understand knowledge and develop skills in science (National Research Council [NRC], 2012; National Science Teaching Association [NSTA], 2014). Better understanding of how early learners respond to STEM tasks could help the education community develop curriculum and more effective teaching and learning pedagogies to support a strong foundation in essential problem solving and thinking skills.

Research Question

A new school year offers unlimited possibilities for teachers to engage children in exciting new learning experiences. What is most important to the educational needs of the children? How should the environment and experiences be planned for students to learn and think critically? This study describes one teacher's journey with her students who are ready to make a move and engage in learning through a new initiative - STEM. How will the children respond? The goal of this study was to gain a deeper understanding of how children in an early childhood classroom respond to STEM lessons designed to develop problem solving skills. The purpose of the study was to examine the responses of children in first grade when they are engaged in STEM lessons. One question guided this research study: How do children in first grade respond to STEM lessons?

Methodology

Research Design

A qualitative design was appropriate to address the research question given the goal of the study. Developing meaning through rich descriptions of experiences remains an important characteristic of qualitative research (Merriam, 2001). This study considered data from field observations, student and teacher artifacts, and teacher interviews regarding participants' thoughts and experiences. Grounded theory was employed to allow for a systematic collection and analysis of data to deepen the understanding of the phenomenon (Merriam, 2001; Strauss & Corbin, 1990). This approach supports research that has not been conducted in this manner with a particular group of people (Strauss & Corbin, 1990). Since this study site is initiating STEM as a new initiative this year, a grounded theory approach provides an appropriate method for this study.

Study Site and Participants

This study took place in a first-grade classroom within a small, rural district in the Northeastern USA. The participants included one teacher with over 25 years teaching experience and eighteen students ages six and seven enrolled in the classroom. STEM education was a district initiative that year. The grade one goals within this initiative emphasized the understanding and application of the engineering design process and two key words: prototype and constraint. This was the first experience for the teacher in integrating STEM lessons. This school was selected based on convenience to the university campus and the researcher. The teacher was selected based on lack of experience implementing STEM activities and her willingness to participate in the research study.

STEM Tasks

The teacher planned and implemented five STEM lessons throughout the year with cross-curricular themes. The teacher implemented the following engineering design process: solving a problem, imagining ways to solve the problem and choosing the best design, creating and testing the design and making improvements to the design. Each lesson was designed with the purpose of connecting it to a skill or theme in another area of the curriculum. Lesson designs that integrate content and skills across disciplines are found to be developmentally appropriate for young children and recommended through the encouragement of play, which results in sustaining successful learning (National Association for the Education of Young Children [NAEYC], 2020; Parker & Thomsen, 2019). The tasks were selected by the teacher to coincide with cross curricular themes and observational data found after each task. The lessons are explained in detail below to demonstrate the sequence of how the lessons progressed and built on each other throughout the school year. Table 1 displays the organization of the tasks.

Table 1

STEM Lessons Throughout the Year

Month	Task	Cross-Curriculum	Materials	Children's Literature
September	If I Were the Fourth Little Pig	Common structures-house; process skills-observations; language development	Straws, foil, play dough, hair dryer/fan, twist ties, Styrofoam plates, tape, popsicle sticks, paper, plastic/paper cups	*Tell the Truth B.B. Wolf* by Judy Sierra *The Three Little Pigs* (any original version)
October	Houses in the Land of Oobleck	Common structures-sink/float investigation; process skills-observations, predictions, tests; language development	Two pans of oobleck, paper clips, popsicle sticks, foil, cotton balls, playdough balls, tape, glue, Styrofoam plates, plastic/paper cups, straws, twist ties	*Bartholomew and the Oobleck* by Dr. Seuss
January	Community Houses	Common structures, Measurement, communities; language development	Butcher paper, paper, crayons, tape, show boxes, rulers, variety of materials from above tasks	Informational Text from Curriculum resources
April	Bridges	Common structures, communities, problem solving; measurement, geometry, language development	4-8 weighted objects, 30 straws, 2 strips of cardstock 3"by12", twist ties, small ball of playdough, hair dryer/fan	*Bridges are to Cross* by Philomen Sturges

Note. STEM lessons were planned during the months when specific curriculum was taught.

Process of Teacher Planning and Implementation

The teacher's goal was to integrate authentic learning experiences to build from as they happened throughout the year. Each lesson was not designed until the previous lesson ended.

One example of this planning approach can be seen in the task of building community houses. This lesson was designed to integrate social studies, math, and language skills. They learned about three different types of communities (urban, suburban, and rural), used units of measurement, read books about different communities, and drew diagrams of their plans for the houses they desired to build, reflecting on their pre and post designs. After reflection, they learned that one group was challenged by maintaining the structure they were building in an upright position. One child in the group decided it could be redesigned into a bridge, which resulted in the next task being focused on building bridges. The following conversation was observed:

Child 1: It (house) won't stay up. It keeps falling over.

Child 2: Wait! It could be a bridge.

Child 3: Yeah! And we can make water go under the bridge.

Child 1: And we can make a car that goes over the bridge.

The teacher integrated student-led ideas to design the next task of building bridges. This exemplifies how each lesson was designed. As each task unfolded, the teacher allowed children the opportunity to play, discover, and express their creativity. The teacher moved with the children as they were given choice and freedom to lead their learning within the context of the learning goals. The teacher implemented regular class meetings to guide the children in reflecting before, during, and after each task. The children were also given the choice to work alone or in teams. Working in teams was the popular choice among the children.

The Fourth Little Pig

Using a spin-off of a popular fairy tale, this task was designed to introduce the children to the engineering design process and structures. The children began to learn how to sketch their designs, work with materials, and test their prototypes using a hair dryer to see if the big bad wolf would blow their houses down. After observing the children build their houses, the teacher wanted to scaffold their learning through using more challenging materials to build another structure, this time testing houses on oobleck after a unit on sinking/floating.

Houses on Oobleck

Discovering the properties of materials through a problem-solving approach helped children use the engineering design process to explore how to build houses that would float on oobleck. During the prior unit, children predicted and tested materials using a water-filled baby pool in the hallway. They sketched, built, and tested a boat using student-selected materials. After this unit, the teacher extended this concept to building houses on oobleck. After reading *Bartholomew and the Oobleck*, by Dr. Seuss, students were given the task of building a house on oobleck. While reflecting on this task, the concept of communities and houses emerged, seeing a close connection between the current unit on measurement, geometry, and the prior STEM task.

Community Houses

The children were given the task of making houses for their "stuffed" reading pets. They had to measure to figure out how big to make the houses to fit their pets and then use various materials to build houses to keep them warm through the winter. This task along with a math lesson on geometry led to the second part of building entire communities. The children were learning about two-dimensional shapes using straws when children suggested they should make houses. With the teacher's permission, they started making a community in the back of the room in place of their normal center time. Concurrently, the children were also studying different types of communities. They made swing sets and other commonly found structures. After building their communities, the teams explained the process of building their communities and described what they included and why. According to the teacher, this task was a pivotal moment when their creativity and ownership advanced through a play-like environment. They began to explore other shapes, such as pentagons, which exceeded the lesson for the day. Figures 1 and 2 display student work as they transformed two-dimensional shapes to three-dimensional shapes and began planning for their communities during the lesson.

Figure 1

Transition From Two-dimensional Shapes to Three-dimensional Houses

Figure 2

Planning Communities During a Student-driven STEM Task

Interactions between group members displayed the application of critical thinking and decision making that demonstrated the acquisition of knowledge. The failure of one structure in the community led to the design of bridges, the next task.

Bridges

Upon realizing the fifth-grade students in the gifted class finished a unit on bridges earlier in the year, the first-grade teacher and the gifted teacher collaborated on the next task, building free-standing bridges. The teachers assigned fifth grade students to work with teams of children to sketch, build, test, and improve their bridges. Concepts, such as the importance and purpose of trusses, were introduced to the children by the fifth-grade students. This collaboration demonstrated the power of children teaching children.

Data Collection Methods

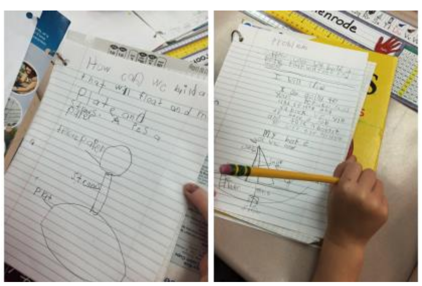
Qualitative data in the form of student and teacher artifacts, field observations, and teacher interviews were collected from September to May in one academic school year. All data instruments were designed as part of the regular duties as a classroom teacher except for the teacher interview questions.

Student and Teacher Artifacts

Student artifacts were collected to examine the student responses to the STEM lessons. Pictures of student prototypes were taken and observed during lessons to study how the students were thinking and describing their learning processes. Teacher lesson templates used during each lesson were collected to observe the lesson design and expectations of the students for each lesson. Children kept science notebooks to reflect on their designs and process in using materials to complete the tasks. Figure 3 displays a sample of student notebooks.

Figure 3

Student STEM Notebooks



Notebook entries and the construction of their prototypes demonstrated the creative problem solving and knowledge children were learning.

Field Observations

Field observations were taken to capture the teacher's approach to teaching the STEM lessons and the students' responses to the lessons within the classroom setting. Student interactions with the teacher, with the content and activities, and with their classmates were observed to gain insight and understanding of their responses while learning. Conversations were observed as students collaborated in teams, and class meetings were observed to uncover meaningful connections as the teacher debriefed with the students before and after the lessons. Children's verbal and nonverbal reactions, classroom setting, time frame, and movement in the classroom were noted.

Teacher Interviews

Informal interviews were conducted and transcribed with the teacher after each lesson. These interviews were open conversations designed to gather a deeper understanding after analyzing previously collected data to gain insight from the teacher. By interviewing the teacher after each lesson, the teacher was able to share reflections of what was happening in her classroom during the lesson, what her expectations were going into the lesson, and how she is going to proceed in planning the next lesson. Each interview provided a better understanding of how and why students were responding to each lesson in a certain way throughout the year from the teacher's perspective.

Data Analysis

The qualitative data collected was analyzed using constant comparative analysis. As data was collected throughout the study, it was continuously compared to each set as it was collected. Merriam (2001) stated, "These comparisons lead to tentative categories that are then compared to each other and to other instances" (p. 159). A critical friend (colleague) was consulted at each step in the analysis to increase inter-rater reliability and credibility of the developments found in the data. Triangulation of all data sources was used to support the credibility of the results, decreasing the opportunity for biased results and illuminating possible additional findings (Leedy

& Ormond, 2001; Merriam, 2001, Patton, 2002). Open coding was used to examine trends and enhance the depth and accuracy of the analysis within the data sets (Strauss & Corbin, 1990). Key words were coded that developed into categories that either reinforced or deteriorated emerging themes. These themes were then triangulated across all data sources to increase credibility of the findings (Fraenkel & Wallen, 2009; Patton, 2002). The data was analyzed in multiple rounds, stepping back from analysis to decrease bias and reveal clarity until saturation was achieved (Fusch & Ness, 2015; Strauss & Corbin, 1990).

Results

The data analysis resulted in a deeper understanding of how children in first grade responded to STEM lessons during a school year. The analysis yielded the results of three themes that emerged across the data sources that described children's responses: value of collaboration, application of critical thinking, positive dispositional characteristics.

Value of Collaboration

The children discovered the value of collaboration, showing their abilities to build relationships, value each other's contributions, and become more aware of the importance of working together. Cooperative learning has been supported as an effective teaching approach through social learning theories. It relies on the premise that learning in an environment of peers working together to develop more advanced language and communication skills and solve problems may be essential in cognitive development (Vygotsky, 1978). During the tasks, the teacher gave the children the choice to work alone or in teams; the children chose to work in teams. When children were asked what they learned, one child stated, "I learned we can stick together and help people." When asked why they chose to work in a team, one child shared the following:

> I wanted to work in a group because then we could add all of our ideas together to make a big house and because we could get done quicker. One person could make a garage and someone else make a trampoline if that's what we wanted to do. I can work with my friends instead of working alone.

Another child stated, "If our ideas were together our house might be strong and if we were alone our house might not be strong." During the last task, one child stated, "We learned to work together. It is easy to get stuff done with a team of really good friends. My friend did a good job making houses and we had fun by working together and making new stuff." When children were engaged in a STEM lesson, they developed their own structure and value in cooperative learning.

Application of Critical Thinking

Children used problem solving skills, analysis, reflection, creativity, decision making, communication, and new knowledge learned while completing each task. One child stated the following:

> The house didn't get blown over. We used materials like popsicle sticks and playdough and taped it together. Then I put a door. I made a door with materials, I put the roof on and taped it so the wolf would not come in the house. We used the straws so to not let the wolf come in down the chimney into the pot like he did in the story.

Another child stated, “I learned there is not just one way to make a house. We tried two different ways.” Another child shared, “I’m a cub scout so it helped me learn maybe in cub scouts we might need to build a boat to fit in…now I would know how.”

A textbook-based math lesson prompted the task of building communities. In an interview with the teacher, it was shared that the children were learning about two-dimensional shapes using straws. Two children suggested they should make houses. With the teacher's permission, they started making a community in the back of the room in place of their normal center time. Concurrently, the children were also studying diverse types of communities, specifically urban, suburban, and rural. They made swing sets and other commonly found structures. According to the teacher, this third task was a pivotal moment when their creativity and ownership evolved through a play-like environment. The teacher stated the following:

> They were not satisfied with flat shapes. They needed to make it come alive so they joined together in groups of two or more to make a community. They showed lots of creativity. They wanted to do more and showed determination to make a community and worked together and wanted to improve things, true life skills.

The teacher also explained they began to explore other shapes such as pentagons, which exceeded the lesson for the day. She continued to share the following:

> They had a choice to work as a team and there was no fighting. They worked from 9:30 until 11:00. We were supposed to stop at 10:00 but they didn’t want to stop…They improved their math lesson all on their own.

The teacher proceeded to share that there was an author visiting that day who noticed the word *prototype* on a poster. The author asked the students what the word meant. One child stated, “A prototype is a model.” The author asked what they were learning, and a few students shared the lesson and prototypes from communities.

In an observed meeting with the children following the task, one student shared, “I didn’t realize houses could be next to stores. We started with roads and then added on. We put on houses, then a store and a parking lot that one of my friends made up.” Another student shared the following:

> One of our constraints was that we only could use six pieces of paper. We learned to work together and have fun. Working together is part of it. We learned what things we need to build it and make things stay up and how to fix things to make them better…I tried to make a skyscraper but that fell down so we decided it would be good for a bridge. Then I thought a car should be on it and a river under it.

Throughout the planning stages of the tasks, science notebooks were completed that showed students’ reflections of their design plans and process in using materials to complete the tasks. While students were working together to complete the communities, their teacher asked them what they were learning, the following responses were recorded:

Child 4: The community is not just one place but a bunch of places. A community has a library, stores, houses.

Child 5: We all worked together to make the middle and made Pizza Hut and we had to take Merrio's Pizza because they were all squished, so we had to spread it out. But Pizza Hut was there, too close together…we wanted to put stop signs and we wanted to put a school, but we didn't have enough room.

Child 6: I made the yellow line because it is a street and has two sides and made sure nothing was on the yellow line in the driveway.

Child 7: I made people and a guy in a wheelchair because he broke his leg and that's why his car is parked in a wheelchair spot. I also made a heart because he [person in the community] cares about him and is near a hospital.

Child 8: We learned about teamwork and how to stick together and be a nice group and do lots of things with my friends.

Child 9: We needed farms and stores and houses and schools to learn and police and fire police to catch people who were bad, and we needed a store for food. We also learned that people have neighbors and sometimes have to drive places which is why they have a car because you can drive far away. We have flowers and trees and a sun and houses and driveways and people in the community. Some people don't see stores and when you live in a city there are lots of lights.

Child 10: I put real police station away from the houses because sometimes bad stuff happens in towns and if he sees something out the window he can help.

Child 11: In the community we decided to make a circle and think about what to do and then plan how to do it and two people could be here to help. I said I had a plan and we started to glue.

Children demonstrated attention to solving problems through engagement of reflection and analysis, skills common to critical thinking (Dilley et al., 2016). Development of critical thinking skills is recommended at the elementary level, including consideration of dispositions (Dilley et al., 2016).

Positive Dispositional Characteristics

The children displayed multiple characteristics associated with a positive disposition towards learning, such as positive emotions of happiness, motivations to engage, acceptance of others and other's ideas, and persistence through challenges. Development of positive dispositions of children is a vital component of learning (Copple & Bredekamp, 2009, Da Ros-Voseles & Fowler-Haughey, 2007). Children were excited showing smiles, hugs, cheers, and comments of growing anticipation before, during, and after lessons. One child shared, "It made me happy about one thing when we all agreed we should say we should start working because one friend said we had 15 minutes, so we all agreed to start working and stop talking…" Another child said, "At first I just wanted to do it by myself and then I wanted to do it with a friend because we can all have different jobs, and it is easy to work as a team."

Children demonstrated an acceptance of others, especially children with special needs. The study took place in a classroom with one child who required an individualized education plan and was nonverbal in kindergarten. Observations portrayed the inclusion of this child as a valued member of the class. This child, referred to as Child A, was engaged in building and working with the other team members, smiling, seemed excited to walk to the resource room to verbally share the finished prototype with the teacher and then return to the classroom. The partner of Child A shared the following:

> I asked (Child A) to be my partner when (Child A) came in the room because (Child A) didn't have another partner and I wanted someone to help me too…I felt happy because first no one was helping me then (Child A) came in and I asked if (Child A) could help me and we decided to make two houses and we didn't know what to do with the straws but then we did.

Child A shared immediately after this statement, "She a good friend and she helped me." Allowing children the opportunities to collaborate resulted in kindness and appreciation for other peers in the classroom, regardless of differences.

Children worked on the tasks for extended periods of time and frequently requested additional time to complete additional tasks they independently planned. They were persistent in overcoming challenges and working until each task was complete. Children did, however, occasionally display frustration during these lessons but continued to persevere until an adequate solution was reached. One child shared the following:

> I started with my partner and had an idea with one ship, and he could build one and I started to get upset because I thought it would sink because it had too much weight, but we tried and put it on, and it fell off and then we tried again and it stayed on a little bit but then fell down.

The teacher asked how they solved the problem. One child said, "we tried and tried again." The teacher concluded they solved the problem without becoming angry and giving up.

Reflection is a critical component of effective teaching and learning practices. Student notebooks, observations, and conversations were imperative to assess the value of the learning experiences. The teacher commented on how valuable the class meetings were in the process, which was an integral component in helping students reflect on their learning, make essential connections, and assist in planning the next task.

The teacher confirmed that students gained three values while engaged in STEM tasks: collaboration, critical thinking, and positive dispositions. The children discovered the value of collaboration, showing their abilities to build relationships, value each other's contributions, and become more aware of the importance of working together. Children used problem solving skills, reflection, creativity, decision making, communication, and new knowledge learned while completing each task. They also displayed multiple characteristics associated with a positive disposition towards learning, such as happiness, motivation to engage, acceptance of others and other’s ideas, and persistence through challenges. Children did occasionally display some frustration during tasks but continued to persevere until adequate solutions were reached. They worked for extended periods of time and frequently requested more time to complete additional tasks they independently planned. Children demonstrated an acceptance of others. The teacher observed a kindness towards one another within the class members, showing excitement to learn and share their discoveries. The teacher observed strengths developing, personalities emerging, and a balance of roles occurring between working members through the experiences.

Discussion and Conclusion

STEM practices incorporate multiple disciplines including science, technology, engineering, and math. It gives students opportunities to participate in higher level thinking skills that involve the 4 Cs (creativity, collaboration, critical thinking, and communication). STEM practices incorporate highly engaging experiences that allow for autonomous learning and developmentally appropriate play. The results of this study suggest that the children responded to STEM lessons in multiple ways, particularly with regards to critical thinking, collaboration, and positive dispositional characteristics.

STEM tasks can help create a healthy culture of learning as children take ownership, show leadership, and develop positive dispositions towards learning and one another. The children experienced productive struggles, demonstrated respect for the unique talents of one another, and grew in confidence that they can make valuable contributions in achieving common goals. This study may be encouraging to teachers who are looking to integrate approaches to learning through STEM tasks that enhance their education by motivating them to collaborate, to be creative, to apply critical thinking skills to solve problems, and to communicate ideas through writing, drawing, building, and discourse.

It is important to note the teacher’s style in allowing the children the freedom to explore through implementing a theory of play approach and have ownership in the structure as the lessons unfolded. This study yielded a rich description of the process the teacher used in planning and implementing the lessons using an interdisciplinary approach as well as building on the prior learning experiences in the classroom to engage learners in the next lesson. Not only is the development of positive dispositions of children important, but the importance of teachers modeling these dispositions is also just as critical (Da Ros-Voseles & Fowler-Haughey, 2007). To this teacher, the opinions and decisions of the children were prioritized, which allowed the children to exercise their creativity and problem-solving skills in a way that made sense to them. The teacher observed their skill levels, encouraged them, and guided them though discoveries that were student-owned; they needed to think for themselves and work together to solve problems - authentic life skills.

Limitations included a lack of generalizability in the study. This study was conducted in one classroom setting which limits the potential for generalizing to a broader population due to a limited sample size. Qualitative research is limited in generalizability but can still be valuable in helping other practitioners discover new perspectives in their own settings and context. (Fraenkel & Wallen, 2009). In this study, the purpose was to gain a deeper understanding in this particular setting, which is common in qualitative research (Merriam, 2001).

Future research is suggested to be conducted with a focus on teacher impact of instructional approaches in teaching STEM education. Continued research in teacher development could provide valuable information to assist in planning for professional development opportunities for educators and developing additional instructional approaches that are effective in helping young children learn in a variety of contexts.

Renewing the practice of purposeful play in early grade classrooms may be worth continued investigation. It appears to offer an environment that empowers students to practice critical skills aligned with 21st century learning while providing a sturdy foundation for success in future education. Children are innate learners who demonstrate a comfortable inclination toward play and exploration. The results of this study support these practices in the classroom, showing children responded positively in a social, cognitive, and interpersonal way during STEM lessons. In making a move toward answering the beginning question of how children respond to STEM lessons, the teacher expressed it simply by stating "They owned it. I just moved with them."

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