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**Developing Self-Efficacy in Mathematics Through Visual Art:
An Observational Research Report on a Preschool Child with Exceptionalities**

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I have no conflicts of interest to disclose.

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Abstract

Albeit hard to acquire, self-efficacy is a skill that, when developed, can inspire problem solving, high confidence, and critical thinking skills. As educators seek to create an enriching, inclusive, and engaging academic environment for students with disabilities, it is important to incorporate strategies for building self-efficacy throughout learning opportunities. In this study, I pose a potential solution to integrate self-efficacy building into mathematical concepts through visual art. The participant in this study is a four-year-old child named Sam, diagnosed with Attention Deficit Hyperactive Disorder (ADHD), sensory input issues, and a developmental delay. Over a four-week period, I performed a pre-assessment, four lesson plans, and a post-assessment. I created the pre/post-assessment to measure his overall demonstration of self-efficacy through an assessment of number sense, critical thinking, and a guardian questionnaire. The four lesson plans each teach a concept related to number sense using visual art; strategies for building self-efficacy are woven into each plan, reinforced by the art related activity. Data from the assessments and observations showed growth in Sam's demonstrations of self-efficacy as well as high engagement and increased number sense. Overall, this study suggests that visual art can increase student engagement in math concepts as well as support explicit strategies for building self-efficacy; however, it did not suggest that visual art alone can build self-efficacy.

Keywords: self-efficacy, visual art, math strategies, early childhood education, teaching students with disabilities, teaching math, art integration

Developing Self-Efficacy In Mathematics Through Visual Art:

An Observational Research Report on a Preschool Child with Exceptionalities

One problem that many early childhood teachers face is how to create meaningful learning experiences that take a multifaceted approach in teaching children. Beginning at a young age, it is critical that they receive enriching opportunities to not only learn about the world around them, but also learn how to socialize, understand their emotions, and problem solve. By creating instructional lessons that focus on curriculum while simultaneously developing important characteristics of independent thinkers, teachers can not only address foundations of reading and math but can also challenge students to become self-sufficient problem solvers.

This is especially critical for students with exceptionalities, as it is critical that they can develop a sense of confidence, self-worth, and independence throughout the learning process. How to effectively meet the needs of these students is the plight teachers must face. In this study, I seek to pose a potential solution. A multitude of studies indicate that art can be effectively utilized in the classroom to develop self-efficacy in students. In a separate search, research also shows that art can be an effective strategy to teach math. Because art is tactile and kinesthetic in nature, I wanted to create a study that uses the mode of visual art to develop self-efficacy in mathematical concepts. The subject of math offers a plethora of opportunities for students to be challenged, problem solve, and find their own ways to a solution. Encouraging this independent thinking can inherently develop self-efficacy, as indicated in the studies that follow.

Celia Cruse, occupational therapist with a master's degree in education, cites that art can develop fine motor as well as problem solving skills. It gives students the opportunity to build on

their communicative and expressive skills, as well as encourage self-esteem and give them the motivation to succeed. Arts give the opportunity to make teaching curriculum more inclusive, especially as children who struggle in certain academic areas may excel at different mediums of art (“The Benefits of Art”, 2019). In a separate study, education students Hei Wan Mak and Daisy Fancourt completed a score matching analysis to study the correlation between art and self-esteem and noticed that higher levels of self-esteem were limited to kids who were involved in art activities at least once or twice a week with their parents. Modes of painting and drawing were most associated with higher reports of self-esteem. This study also cited that engagement in what art students were creating played a greater role in develop self-esteem as opposed to their abilities (2019).

An additional study observed the results of early childhood students who used an art integrated math program, called the Wolf Trap program, as opposed to math programs that do not use the arts. The Wolf Trap program takes an art integrated approach to teaching science, technology, engineering, and mathematics (STEM) and has received a grant from the U.S. Department of Education in doing so. The part of this program studied provides over 100 hours of professional development to teachers of pre-kindergarten and kindergarten in how to integrate art strategies to teaching mathematics, including almost 50 in-service hours with professional teaching artists. These strategies encompass music, drama, and dance. After the professional development was completed, teachers implemented the learned strategies in their classroom over one year. The results showed that students who used the art integrated program yield 1.3 additional months of learning as opposed to those who did not use art integration (n.a., 2016).

An additional study of this same program compared two groups of students, one through traditional means of instruction and another with integration of art. Four math tests were

administered afterwards, and the group with art integration yield higher results. This study notes the consistency in their findings with that of prior research: art offers advantages to math, such as intrinsic motivation, visual imagination, generating creative ideas, and learning how to reflect on it all. Art encourages students to channel their emotions and theoretical concepts, which inherently becomes more fluent in their mind as they relate them to personal connections. Students become motivated to learn when they are engaged, and art can help with this. This study also cites research from Burton, an art professor at Columbia University. In his research, he found that math and science require cognitive and creative skills when learning, which are regularly developed in art practice. Students using an art-based curriculum will show improved creative thinking in perception, problem solving, and self-expression. They were also more willing to take risks and collaborate with others (Brezovnik, 2015).

Tracey Hunter-Doniger, writer for the National Association for the Education of Young Children, compiled from research a list of why art is so important to be used as a means of learning. Art teaches problem solving- it engages the imagination, makes harder subjects easier to learn, builds confidence during the learning process, and encourages a desire to learn (2016). As indicated by the above information, there has been a multitude of support, both anecdotal and research based, that supports the notion of art supporting problem solving, self-esteem, and engagement as well as mathematical concepts. The goal of this study is to integrate art concepts into mathematical lessons with the intention of self-efficacy building. I chose the term 'self-efficacy' rather than self-esteem or problem-solving skills, as I feel it can encompass both. Self-efficacy is a skill that children need to acquire in order to tackle challenging problems on their own, feel confident in their abilities to solve, and feel secure enough in their learning to ask for help when needed.

This study focused on children with disabilities, as in a typical classroom setting, they need additional support and resources individualized to their needs. If we find that a child who needs additional accommodations can effectively understand mathematical concepts and build self-efficacy, then we have found a way to not only reach their needs but also reach those of students who do not need additional support.

The definition for self-efficacy used in this study, derived by *Bandura in Self-efficacy: toward a unifying theory of behavioral change*, is “an individual’s belief in his or her capacity to execute behaviors necessary to produce specific performance attainments” (191-215). High self-efficacy will be measured through various behaviors, such as retrying a task if failed the first time, performing behaviors modeled by the educator with little to no guidance, and recognizing accomplishments they have made through verbal and nonverbal cues. Nonverbal cues could include clapping for themselves, smiling, laughing, or dancing. Low self-efficacy will be measured through acts of giving up, negative self-talk, and shying away from tasks that may seem difficult to them.

Method

Participants

In this study, I worked with one student in particular- a five-year-old child with exceptionalities, referred to as Sam. Sam was diagnosed with Attention Deficit Hyperactive Disorder (ADHD), sensory input issues, and a developmental delay. He currently has an individualized education plan (IEP) and receives individualized services; he attends school at a private preschool and halfway through the day attends public kindergarten. His mother completed a brief questionnaire as a part of the preassessment and post-assessment. There were also two teachers who participated in an interview for this research. They were given the same

set of questions; one is a Kindergarten teacher, and another is an early childhood intervention specialist.

Procedure

I met with Sam and his mother a total of six times over the course of four weeks. During the first week we performed the preassessment. During the second week I conducted two art-integrated math lessons in an individualized learning setting for Sam, without his mother present. In the third week I repeated this process with two different, art-based math lessons. In the fourth week I completed the post-assessment with Sam and his mother. We met at approximately 3 p.m. each day, right after he got home from school. These plans were performed in a rented resource room from a local library. The room consisted only of a whiteboard and large rectangle desk with chairs. The art-based lessons were specifically visual-art related and included concepts of number recognition and addition with extensions of subtraction and comparison.

For the preassessment and post-assessment, three areas were assessed. The first area was his understanding of numbers and addition with general question and use of manipulatives; the second area was his ability to handle a challenging task, which was placing different shaped blocks into a box puzzle; the third was a guardian questionnaire with questions pertaining to self-efficacy (see Appendix A). Scores were accrued via rubrics. A list of specific behaviors was expected from the proctor (myself) in order to assess Sam's response to challenging tasks. I was not allowed to help Sam unless he asked, was not allowed to give him the right answer, nor any praise.

Throughout each detailed lesson plan, explicit moments for self-efficacy building strategies were implicated to be used with Sam. These strategies included explicit praise when he

accomplished a challenging task, reminders to ask for help when he needs it, not giving him help unless he asks, giving him choices, and encouraging him when he makes mistakes. To further support the use of these strategies, measurable goals were created to measure not only the math and art standards being taught, but also for demonstration of self-efficacy from Sam (refer to Appendices B, E, H, and K).

The first lesson plan used the concept of ‘number squashing’, with numbers placed in sandwich bags and a correlating number of paint dots on the number for the child to touch as he counted the number of dots (refer to Appendix D). The second lesson involved creating the number symbol that was represented by a certain number of manipulatives with various art tools that could be chose from (refer to Appendix G). The third lesson involved finger stamping to practice one-to-one correspondence, addition, subtraction, and comparison (refer to Appendix J), and the fourth one involved gluing tissue paper squares to construction paper to practice one-to-one correspondence, addition, subtraction, and comparison (refer to Appendix M).

For further assessment of understanding and self-efficacy demonstrations, an observational list and personal reflection was completed with each lesson plan. All observations of examples of self-efficacy were recorded as well as Sam’s understanding of math concepts. A ‘key’ was designed to specifically identify high efficacy and low efficacy behaviors (refer to Appendix C), such as RT = retrying a task initially failed, PB = performing behaviors modeled, RA = recognizing accomplishments made, and more. To further analyze my pedagogical development, I also reflected on my abilities to teach, how I adhered to his understanding/lack of throughout the lesson plan, as well as what I could do differently or how I could adjust my teaching to meet his learning with the next lesson. This also provided me the opportunity to reflect on my execution of this study as a whole.

Results

Preassessment results

In the preassessment, Sam received an 88%, already demonstrating a high sense of self-efficacy. In the domain of math concepts, he received an 83%. While he was unable to answer all questions correctly, (he only answered 50% completely correct), he scored high on the rubric because he persevered through the problems he did not know, focused on the tasks at hand, and asked for reassurance. His biggest deduction was that he did not show signs of confidence; he would show a frowning face or hang his head if he knew he couldn't figure out the answer. There were times where he was noticeably frustrated and did not ask for help. In the second domain of assessment, response in a stressful situation, he received again an 83%. He was able to successfully solve the puzzle; however, he did not show any positive self-feedback when he was able to successfully solve. Many times, he just tried to shove pieces into different holes, but began to realize what he was supposed to do when he said 'rectangle' and made the connection between the shape and the hole in the box. Each time he successfully got a shape in there he elicited no reaction until completed- he breathed a sigh of relief and smiled. There was one time he asked for help with the diamond without my prompt; he was not frustrated but showed signs that he was defeated- poor posture, head hanging, and soft spoken. In the guardian questionnaire, he received an 86%. His biggest struggles, as noted by his mother, are that Sam will persevere through difficult tasks, but only if they hold his interest. Whenever he is encouraged to talk to others, they typically must guide his responses. He does not often initiate conversation (detailed notes regarding assessment are found in Appendix A).

First lesson results

Overall, Sam was engaged in the lesson, but not challenged. That stated, he met all of the measurable goals, including the goal regarding self-efficacy (refer to Appendix B). He was able to recognize all of the numbers presented to him, even before ‘squashing’ the paint dots. He quickly made the connection by asking me, for example (when referring to the number 8), “Is there going to be eight dots on that number?” In his preassessment, he could only count to the number 10, so this activity could be performed again to practice identifying 11-20. In relation to self-efficacy, he showed several high-efficacy behaviors, such as demonstrating behaviors modeled, curiosity, inquisition, engagement, and recognizing his accomplishments (detailed notes regarding specific behaviors are found in Appendix C).

Second lesson results

In the second lesson, Sam was able to meet the measurable goals of one-to-one correspondence, representing number symbols, and choosing his own methods of creating them. He was thoroughly engaged with this activity and particularly excited to use the paint to create the numbers. When exploring materials, he was able to identify all of them, but quickly chose to use paint. Before painting, I used the interactive modeling process to teach him how to paint. Throughout the lesson, he created a mnemonic for himself to remember the steps of how to paint: ‘dip, dry, flip’ to refer to dipping the paint brush in water to clean it, drying it on the paper towel, and flipping over the paint brush when he needed more paint. He was correctly able to identify the number of manipulatives he pulled and did so by identifying the number symbol from a set of three different number cards. He then attempted to paint this number. The numbers are slightly illegible, but the numbers he drew were 3, 9, 8, and 5 (refer to Appendix G). He drew the 9 and 3 backwards. After the lesson ended, he expressed interest in continuing to color with paint, and did so by creating a rainbow. Multiple defined behaviors of self-efficacy were shown

in this lesson- independently exploring materials, performing behaviors modeled, retrying a task initially failed, recognizing accomplishments he has made, demonstrating curiosity, and asked for help when he needed it (detailed notes regarding specific behaviors are found in Appendix F).

Third lesson results

With the third lesson plan, Sam was able to meet two of the three measurable goals. These goals involved adding, describing the process of making his art, and guide himself in creating and adding. He was unable to meet the latter, as I had to guide him through the concept of adding by pointing to each dot as he counted. The strategy of self-efficacy involved metacognitive thinking by asking him to reflect on what he has created. He was also quite engaged with this lesson, as he loved the concept of using his finger to create art through stamping.

When asking reflective questions regarding how he made the art, he was able to accurately answer them; however, I had to be more specific with several of the questions. For example, when I asked, “what did you need to make this art,” he was silent. Rather, I had to ask him ‘what did you use?’ and ‘how did you use it?’ he responded to these questions, but nonverbally by pointing and mimicking the process of placing his finger in the stamp and putting it on the paper. When asked, ‘what colors did you use to make this art,’ he pointed to the ink pads, but I had to ask, ‘what colors are they,’ to which he answered. When asking him how the art makes him feel, he said, ‘happy,’ to which I asked why, and he said, ‘because they are the colors of the rainbow,’ although not all of the colors of the rainbow were present in the ink pad selection. He was challenged by these reflective questions, as often he would pause or be silent during them. He never gave up or refused to answer a question, but rather would go quiet and

look at me as if he did not understand. I would modify my questioning and he would respond just fine.

Similarly, when asking him to add the groups of stamps, I had to modify my questioning. He did not understand the word ‘addition, but when asking him how many finger stamps, he saw ‘altogether’ he understood. I had to point to each stamp as he counted. I decided not to explore concepts of subtraction or comparison very much as he showed, as he already seemed challenged by the concept of addition. In relation to concepts of self-efficacy, he demonstrated several behaviors including curiosity, recognizing accomplishments he made, and he also recognized my mistake when I miscounted the number of manipulatives I pulled from a cup (detailed notes regarding specific behaviors are found in Appendix I).

Fourth lesson results

The math related goals for this lesson involved adding, with extensions addressing subtraction and comparison. In relation to art, Sam was asked to communicate his opinions on his art as well as the instructor’s art; in relation to self-efficacy was encouraged to explore the materials used to create the art to determine how he would create it on his own. He was able to successfully meet all of these goals, including the extension. He understood the concept of ‘more’ when comparing the number of squares on my art to his (refer to Appendix K) as well as subtracting when I would use simpler words, such as ‘if I hide [x] amount of squares, how many do I have left?’ When asking him what he thought of his work, he said he liked it because he made it into a heart for his mom. He specifically asked me before making it a heart if I could draw a heart for him to glue the squares on. At the beginning of this lesson, he was able to successfully identify what we would be doing with the glue and that we would be gluing the squares onto the paper. In this activity, he demonstrated several behaviors of high self-efficacy,

including curiosity regarding the lesson, independently exploring materials, recognizing accomplishments he made, coming up with his own ideas, asking for help with creating them, performing the behaviors modeled, admitting his lack of understanding without being upset, and justifying his choices without prompt (detailed notes regarding specific behaviors are found in Appendix L).

Post assessment results

In this assessment, Sam received a 94%. He excelled with a 100% in both part I and part II of the assessment and improved in one area as reflected on in part III, the guardian questionnaire, having to do with independent use of the restroom. He answered every question correctly of part I, related to math concepts. Before I even began the assessment, he began playing with the Unifix cubes without prompt. He connected several of them and asked me to count them; when I counted them correctly, he told me, “Good job!”. On the problem where he pulled manipulatives from the cup, he was able to do so independently and recognized two cubes that were stuck together as two. He was also able to correctly compare two groups of cubes in the last two questions of this part, which he initially was unable to do. He added the cubes as well, without guidance. In the second part, Sam solved the puzzle with significant ease. The several he was stuck on he realized to rotate them or to try other holes. Immediately after getting the shapes into the holes on several occasions, he would yell, ‘yes!’ or ‘yay!’. However, as it became more challenging, the more quiet and attentive he would get. The trapezoid he found challenging, as he tried to fit it in a square-shaped hole; however, he explicitly asked for help by saying: “Ever, can you help me with this?” On another account, he said, “I can’t figure this one out,” and handed it to me (detailed notes regarding specific behaviors are found in Appendix N).

Interviews

In the interview below, I ask both a Kindergarten Teacher in a private school and early childhood intervention specialist in a public school their experiences using art in the classroom. They both work in the same school district and have several years of experience.

Interviewer: What are your beliefs on using art in the classroom?

Intervention Specialist: I personally believe that you can learn a lot about a person through art, especially young children. I enjoy process art within our classroom versus "crafts." I like to provide a variety of materials for my students that allows them to be creative and open-ended. For example, a few weeks ago, [Sam] used a variety of materials to create a treasure map. Without any prompting he was able to provide me with the backstory to his creation as well.

Kindergarten Teacher: I believe that it is important to use art in the classroom. I think art is a good way for the students to express themselves in ways they may have never thought about. There is no right or wrong way to create art. It is important for the students to know what they are creating and be able to explain it. I think as students get older, [sic] they can use art more in the classroom because they have been exposed to a variety of ways of learning so they can pick the way that makes the most sense to them.

Interviewer: In what ways do you build self-efficacy in your students?

Intervention Specialist: We have three key sayings in my classroom, "I can try hard things," "I can do hard things," and "Be a problem solver." [sic] Preschool age is where I see a lot of kiddos begin to lose their faith in their own abilities. They begin to question themselves, and truly rely on others' thoughts and opinions. By encouraging the kiddos to become problem solvers and mindfully work on executive functioning skills daily, their self-confidence, stamina, and overall ability to function within a classroom environment increases.

Kindergarten Teacher: In my classroom, we do a variety of ways of learning. There are times that we are all sitting at our seats learning as a class, we will move around the room to work with a partner [sic] and we will work individually around the room. I find this to be beneficial in my classroom because I am able to meet my student's needs in a way that they understand a topic and are not overwhelmed. I make sure that the task I am presenting to an individual will not make them feel discouraged or embarrassed. I also provide positive reinforcement or help to steer the child into other ways of thinking if they are off track on the particular assignment.

Interviewer: How often do you use art to teach common subjects (English, Math, Science, History)?

Intervention Specialist: 1-2 times per week. For example, we created jack o' lanterns today which incorporated math and language arts.

Kindergarten teacher: In the kindergarten classroom, we are focused more on learning the fundamentals in a basic way and do not try to get too creative in integrating art. As the year progresses, I hope to have the students draw pictures to go along with periodic journal writings.

Interviewer: Can you recall any experiences you have had using art to teach a subject, good or bad?

Intervention Specialist: One of my favorite projects was during my first year of teaching. The students used objects they collected on a scavenger hunt to create a nature collage. The kiddos were sent out with homemade binoculars and told to find certain items. We then used a large piece of paper to create a tree out of those objects (leaves, acorns, twigs, etc.).

Kindergarten Teacher: I taught a unit on outer space. During this lesson, I tried to incorporate a number of art activities to help the students visualize what I was talking about. We created a moon with texture to show that the moon is not smooth because it has craters. We discussed what satellites need in order to be effective. Once we were done discussing, the students were able to create their own satellite using paper towel rolls, foil, pipe cleaners, and foam stickers. This helped the students to actually see what we were talking about, and it helped them to get a better understanding of how satellites work. This also gets the students to explain their artwork and what trying to portray.

Interviewer: Do you think that self-confidence and independent learning can be built through creative activities, such as creating art? Why or why not?

Intervention Specialist: Yes, but for some students it takes more time and encouragement than others. I have found that explicitly teaching the function of each material and how to correctly use it helps the kiddos with the first step. We can't expect them to use scissors and glue to create something if they have not experienced such things before.

Kindergarten Teacher: I think self-confidence and independent learning can be built through creative activities. This is a great way to meet the students where they are. By allowing students to create their own art, they are able to express their learning in ways that make the most sense to them. We know that every child learns differently, so we cannot expect them to show their learning in the same way.

Interviewer: Research indicates that art can help foster fine motor skills, creative thinking, independent learning, problem solving, and a willingness to make mistakes as well as explore (Wan Mak & Fancourt, 2019). In what ways have you seen art benefit your classroom?

Intervention Specialist: I have seen all of those skills increase for students in my classroom. Again, some students need more encouragement, but once they have success, they want to try more, even if mistakes happen. Some of my current students who struggle with fine motor skills always pick the art center to explore in and are so excited to take their creations home to show their parents.

Kindergarten Teacher: In my classroom, we use art as much as we can. When teaching these lessons, I explain to the students the directions and what the goal of the assignment is. I make sure that they know how to do it safely if they are using scissors, and then I let them work on their own. If they get confused or get stuck, I step in and help them, but I like to see what they can do on their own or how they work through problems. This benefits my classroom because it encourages my students to work independently and build self-confidence. I also display their artwork afterward so they can take pride in what they have created and get ideas from what others have done.

Interviewer: In my case study, I am using visual art to help build self-efficacy in mathematical concepts in a preschool child. Do you have any experiences working with students to develop self-efficacy in math, specifically in art? What strategies do you find successful?

Intervention Specialist: I cannot say with art specifically, but strategies that I use to help my students are setting clear expectations for the activity, allowing them to explore the materials for a few minutes in their own way before engaging with them, modeling, and providing as much positive feedback as I can. I try to make my students feel like the most amazing little humans in the world when I'm working with them. Another key thing is to make it fun! For example, if we are playing a number recognition game, I'll have students count the objects and provide me with

the corresponding number card, however, I make them surprise me. I'll close my eyes, and when they think they have the answer, I open them. They love it!

Kindergarten Teacher: In math, we are able to use a variety of manipulatives to help the students visualize the concept they are learning. Colors, shapes, textures, and sizes are some of the basics tools used to emphasize concepts such as sorting and patterns as well as counting and math equations.

Discussion

As past research indicates, art can help students develop a sense of pride in their accomplishments, which can translate into stronger feelings of self-worth (Wan Mak & Fancourt, 2019). Implementing explicit strategies of boosting confidence and autonomy, such as explicit feedback, moments for praise, independent choice in creating art can all work to develop self-efficacy (Graham, 2017). I utilized each of these strategies in my lesson plans, and with each plan I saw more examples of Sam's developing confidence (refer to Appendices C, F, I, L).

I saw growth in Sam's progression from numerical recognition to addition, subtraction, and comparison, which is supported by studies completed to compare the benefit of teaching math curriculum through art integration. With art, students have the opportunity to recognize patterns, count quantities, and solve problems in math (Brezovnik, 2015). Moreover, using art to teach math provides a plethora of hands-on and sensory learning, which specifically helps students with disabilities. Sam remained engaged with each lesson, which increased his ability to focus. This was shown throughout his demonstrations of self-efficacy such as when he noticed my mistakes or developed mnemonics to remember how to clean his paintbrush. Each lesson involved tactile learning experiences, whether it was through squishing paint dots, using paint to

draw, using his finger as an art tool, or connecting tissue paper squares to construction paper.

From his engagement with each lesson, I infer that he is a kinesthetic learner- typical of students with ADHD. These projects gave him a prompt but also encouraged him to use his creative thinking to solve these prompts, thus creating active learning opportunities.

Independent learning activities can encourage self-confidence by asking students to apply their knowledge to solve a problem and asking for help as necessary (Feng, 2015). Bandura (1994) believes that self-efficacy is created through experiences, both positive and negative, and how we react to them. In any productive learning environment, it is critical that students get these experiences and learn from them- regardless of if they are positive or negative. As teachers, we are here to foster these experiences as well as guide their feelings and attitudes to encourage a greater sense of self-efficacy. Overall, I believe this to be effectively demonstrated throughout my experiences with Sam, as he not only showed interest in each lesson, but developed a greater understanding of beginning math concepts. Despite already scoring high in his preassessment, he still grew in the end- demonstrating defined behaviors of self-efficacy, including recognizing his accomplishments, asking for help as he needed, and never feeling defeated when he knew he was wrong. While visual art alone did not encourage these self-efficacy strategies, they provided the pathway for me to reinforce them in an organic way.

In relation to the interviews conducted with the intervention specialist and kindergarten teacher, their anecdotal supports align with the evidence I have found in my research as well as in my study. Both teachers recall on how art supports the development of self-efficacy as well as problem solving and engagement in the classroom. They share positive experiences of using art in the classroom as well as note similar methods of developing self-efficacy as used in my procedure. Examples include praise, honest feedback, independent opportunities for learning,

and exploration of materials. Research accumulated in this report supports the notion that art is beneficial in teaching math, and that art is beneficial in developing self-efficacy, but I was unable to find research indicating that they can be related. Further studies, similar to this one, should implicate art as a tool to develop self-efficacy in subjects, going beyond just math.

Because this was an independent study with a single child, there were several limitations to my research. I funded this project by myself during the middle of a pandemic; therefore, my resources and opportunities to expand my project were limited. I worked with a child who I knew personally but have worked with professionally in the past; moreover, not only was I an observer in this study, but I was also a participant. This means that I relied on my own observations of myself rather than someone else observing my teaching. In the future, if this study were to be expanded or replicated, it should be done by several observers that observe art integrated lesson plans taught by another teacher or multiple teachers. While the relationship between myself and the student could provide limitations in this study, I also believe it supported a more authentic dynamic when teaching. I already am familiar with the learning styles Sam prefers, what prior knowledge he has, and how to effectively teach him regarding his exceptionalities. In any educational setting, it is critical that the teacher knows the students they are working with. One thing I did not anticipate nor realize was how high Sam's self-efficacy was. It was reassuring to see improved results when comparing the preassessment to the post-assessment; however, if this study were done in the future, I think a more explicit result would be yielded from students with lower ratings of self-efficacy.

In other limitations, my pre- and post-assessment was entirely self-created. I developed it from an accumulation of other assessments and studies, such as Bandura's self-efficacy scales (2006), Rosenberg's self-esteem scales (1965), and a study done on self-efficacy in preschoolers

(Hoskovcova, 2013); however, this is the first time it has been used, therefore cannot be ruled as reliable and/or valid. In future studies, this assessment could be modified to look for more explicit behaviors rather than simple observations. This would make the rubric more definite as I noticed when scoring using the rubrics that the behaviors Sam displayed went beyond what I defined in the rubric. Moreover, these assessments could be performed by multiple observers when observing a teacher interacting with the student. The questionnaire, while I felt it was important to get a guardian input (as they are around their child the most), it may not be as necessary when this study is performed with multiple observers and/or as a longitudinal study. While this observational study was performed over several weeks, it was overall brief, and the child was still receiving educational services in between our meetings. This could also have skewed the results.

Although this was an independent study performed at a very small scale, it did represent interesting findings on several accounts. It showed how actively engaged a child with hyperactivity and attention deficits could be when using art as a tool for learning, especially when it is tactile. Moreover, I did see positive results throughout my study. During each lesson, I saw Sam demonstrate numerous explicit behaviors of high self-efficacy, especially those that I had not noticed during the pre-assessment. During the pre-assessment he showed signs of sadness and defeat when he didn't know the answer or was confused; however, throughout each lesson and in the post-assessment these behaviors were either minor or nonexistent. He independently asked for help before getting frustrated and never once seemed defeated when he didn't know the answer or got it wrong. Moreover, he never gave himself any positive reinforcement in the pre-assessment when getting math questions right or solving the puzzle; however, I noticed through the lesson and especially during the post-assessment positive

reinforcements for himself- he even gave me a positive reinforcement after asking me to count the number of manipulatives.

In future research, I believe this study should be further explored. In my personal endeavors as a teacher, I would love to regularly implement art as a means of teaching subjects beyond just math. I have seen throughout this project not only a deeper interest in learning, but also growth in personal development in terms of confidence, autonomy, problem solving, and decision making. In other studies, this concept could be taken and expanded to reach wider groups of students with varying disabilities as well as other subjects. I also believe that this topic could go beyond just preschoolers, especially as self-efficacy becomes more critical to develop at later ages in early childhood.

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Appendices


Appendix A

ASSESSMENT ON SELF-EFFICACY FOR THE P Sam's Pre-Assessment CUS ON MATHEMATICAL CONCEPTS

"For a preschool student, self-efficacy can be defined as the independent initiation of learned behaviors. High self-efficacy will be measured through various behaviors, such as retrying a task if failed the first time, performing behaviors modeled by the educator with little to no guidance, and recognizing accomplishments they have made through verbal and nonverbal cues. Nonverbal cues could include clapping for themselves, smiling, laughing, or dancing. Low self-efficacy will be measured through acts of giving up, negative self-talk, and shying away from tasks that may seem difficult to them."

Early Learning Content Standards Covered in Assessment

- Domain: Cognition and General Knowledge
 - Sub-domain: Mathematics
 - Strand: Number Sense
 - STANDARD STATEMENT: Count to 20 by ones with increasing accuracy.
 - STANDARD STATEMENT: Identify and name numerals 1-9.
 - STANDARD STATEMENT: Identify without counting small quantities of up to 3 items. (Subsidize)
 - STANDARD STATEMENT: Demonstrate one-to-one correspondence when counting objects up to 10.
 - STANDARD STATEMENT: Understand that the last number spoken tells the number of objects counted.
 - STANDARD STATEMENT: Identify whether the number of objects in one group is greater than, less than or equal to the number of objects in another group up to 10.
 - Strand: Number relationships & operations
 - STANDARD STATEMENT: Count to solve simple addition and subtraction problems with totals smaller than 8, using concrete objects.
 - Strand: Algebra
 - STANDARD STATEMENT: Recognize, duplicate and extend simple patterns using attributes such as color, shape or size.
 - STANDARD STATEMENT: Sort and classify objects by one or more attributes (e.g., size, number).

Name of child: 

Date: 9/2/21

Time: 4:30pm

Note: It is important when performing these tests that you do nothing to reinforce or discourage any behaviors. This assessment is designed to observe the child's behavioral and emotional response when faced with complex tasks, specifically in math. The goal of this assessment is to show improvements in the child's self-efficacy after using art to teach mathematical concepts related to the standard statements above.

Part I: Math Concepts

→ Follow each prompt below with the child. You will need at 10 manipulatives (see Appendix A) and two cups. In the section titled 'notes' below each prompt, record the child's response as well as observations made as they solved the problem. If they ask for help, give it to them, but make sure to record that. If they show any emotions, verbally or nonverbally, record this as well. Do not give the child any answers, and do not give them any praise or feedback. Use the rubric at the end of this document to analyze and score this section of the assessment.

1. Ask the child if they know how to count to 20. Then, have them demonstrate.

a. Notes: Child can count to 10. Says 'I can't count any higher' when asking if he knows other #'s, said '26' and '13'.

2. Using the cards at the end of this document, ask the child to identify each number. Make sure to cover up all numbers except the one being identified if you show them on a single sheet.

a. Notes: Can identify all but '8' and '10'. Says 'I don't know that number' recognizes it is a number.

3. Create 4 separate groups of manipulatives. Place 1 manipulative in the first group, 3 manipulatives in the second, 2 manipulatives in the third, and 3 manipulatives in the fourth. Ask the child to count the number of manipulatives in each group.

a. Notes: Identified all groups correctly and with ease. Counted by knocking each cube off table while counting.

4. In a cup, place 10 manipulatives. Ask the child to count each manipulative in the cup. It may be necessary to guide them in this, such as demonstrating taking a manipulative out one at a time to count them. As a follow up, after counting all of the manipulatives, ask, "so how many are there in total?"

a. Notes: Completed this task with ease. Again, chose to throw them out of the cup to count them. I asked, 'how many blocks did you throw out of the cup?' He responded '10'.

5. Create two groups of manipulatives. One will have 5 manipulatives, and one will have 8. Ask the child which group has more manipulatives.

a. Notes: Easily counted both groups, but said the group with less blocks had more. He was sure of this when I repeated the question. He asked, 'Am I right?' but I did not respond.

6. Create two groups of manipulatives, one that has 2 manipulatives and one that has 4. Ask the child how many are in the first group, then ask how many are in the second. Finally, ask how many manipulatives there are in total.

a. Notes: Similarly, he counted both groups accurately but did not understand the concept of 'more' when I asked him which group had more.

Throughout each of these questions, he was never frustrated or hesitant to solve a problem. He would either be right, be wrong and think he's right, or say 'I don't know'.

Part II: Response in a Stressful Situation

- Have the child solve a shape puzzle (see Appendix B). Explain to the child that they need to get all of the blocks into the box. If the child asks for help, give it to them, but make sure to write this in the note section below. Observe how they react when they get stuck on a shape; how they react when they successfully get a shape in the box; if they ask for help; if they identify the shapes; if they give up; how they respond when they succeed, and any other observations regarding emotional response or dependency/independency when solving the task. Visit the rubric at the bottom of this document to score this part of the assessment.

- Notes:

Initially struggled to fit peices in the box; would try to force peices in first ~~whole~~ he saw. Some shapes he recognized and would look for the corresponding hole; he was focused while solving, but never got frustrated when he had a peice he couldn't fit in the puzzle. He never asked for help, but once with the diamond shape. I showed him which side the diamond hole was on but he would try to force it through on the wrong side. He identified multiple shapes accurately or close to it - square as a square, rectangle as a square, star as a star, oval as a circle, trapezoid as a square as well as a triangle. When he successfully got a shape in the box, he ~~illicit~~ no reaction until he got all shapes in the box. He breathed a sigh of relief and smiled. He would often talk to himself, saying, 'It doesn't fit in here [the hole]' or 'I can't find the hole' or 'I don't know where this goes' but it was never with much emotion; he seemed focused and inquisitive. On shapes he

He was not frustrated when asking, but sounded defeated

Struggled with (aside from the diamond), he would put it down and try another shape. After struggling with a few shapes back-to-back, he focused his attention on me, asking me about my shirt and telling me he liked my bracelet. Before I needed to redirect his attention, he was back to focusing on the blocks. He was able to get all of the blocks in successfully. There were two times, aside from the diamond, that I helped him by showing him what side the shape was on. He got these shapes in successfully by showing them in and rotating them as opposed to comparing the face of the shape to the holes. Overall, this took Joey about 5 ~~minutes~~ minutes.

Part III: Guardian Questionnaire

→ This part of the assessment will be completed by the child's primary caregiver(s). If given to multiple caregivers, have them complete this separately and at the same time so they do not share or disclose their answers with each other.

Guardian: With each prompt, circle the response most applicable to your child.

1. My child can brush their teeth on their own.
 - ☒ a. Yes, without prompt.
 - b. Yes, but I have to encourage them/put toothpaste on their toothbrush.
 - c. No, I have to brush their teeth for them.
2. My child can get dressed on their own.
 - ☒ a. Yes, my child can get dressed without assistance.
 - b. Yes, but I have to and supervise.
 - c. No, I have to help them get dressed.
3. My child can use the toilet without assistance.
 - ☒ a. Yes, my child knows to use the bathroom and I do not have to assist.
 - ☒ b. Yes, but I have to guide and help them as necessary.
 - c. No, my child does not yet use the toilet.
4. My child likes to try new things, such as new activities or food.
 - a. Yes, my child is always willing to try new things, even if they are nervous to do so.
 - ☒ b. Yes, but it takes a lot of persuading sometimes.
 - c. No, my child gets angry or frustrated when encouraged to try new things.
5. My child is friendly around people they do not know.
 - ☒ a. Yes, my child will initiate conversations with new people.
 - b. Yes, but I must guide my child to talk to new people.
 - c. No, my child is completely shy around new people.
6. My child will persevere through a challenge, despite any troubles they may face.
 - a. Yes, my child tries to work through any hard task they may face, even if they become frustrated with the process.
 - ☒ b. Yes, my child will persevere through most challenges, but if it does not keep his interest he will give up.
 - c. No, my child avoids any tasks or challenges that are too hard for him.
7. My child likes to learn new things, whether prompted or if it is something he finds interesting.
 - ☒ a. Yes, my child is often willing to learn new things.
 - b. Yes, but I must encourage him.
 - c. No, my child does not often like to learn new things.
8. When coming home from daycare, my child initiates conversations about what he did during the day.
 - a. Yes, my child frequently talks about his day at school.
 - ☒ b. Yes, but I typically have to ask specific questions about his day to learn more about it.
 - c. No, my child seldom talks about his day at school.
9. Overall, I feel that my child displays high self-confidence at home and in school.
 - ☒ a. Yes, my child is confident in who he is.
 - b. Yes, but he can be shy in unfamiliar situations and around new people.

- c. No, I would say that my child is not very confident.
10. Overall, I would say that my child learns a lot through exploration.
- a. Yes, I see my child to be an independent learner.
 - b. Yes, but my child must be encouraged to explore.
 - c. No, my child does not learn independently and through exploration.

RUBRICS

Rubric for Part I: Math Concepts

	1	2	3
Accuracy	The child responded with the correct answer to at least 2 questions.	The child responded with the correct answer to 3-4 of the questions.	The child responded with the correct answer to 5-6 of the questions.
Ability to solve	Observations show that the child struggled in solving at least some problems and was reluctant to do persevere. He did not ask for help when solving.	Observations show that the child struggled to solve some problems but was willing to ask for help. He worked through the problems despite having difficulty in solving them. He noticeably put forth effort to try to solve the problems.	Observations show that the child asked for help as needed or did not need help. He was eager/more than willing to solve each problem and looked forward to the next. He took time in trying to solve each problem, especially those he found challenging.
Emotional Response	Observations show that the child was frustrated and unmotivated to solve the problems. Nonverbal and verbal cues show that difficulty solving problems led to distraction and negative attitudes, such as anger, frustration, and disengagement.	Observations show that the child would get noticeably frustrated when solving problems, but his attitude would shift when getting help. When he solved a problem correctly, he would demonstrate positive reinforcements, such as clapping, telling himself he did a good job, phrases such as 'yay' or 'I did a good job', or anything similar (as noted in the observations).	Observations showed positive attitudes throughout the process, even when struggling with a problem. He persevered through the problems and never showed signs of disengagement (such as distraction, looking around the room, asking irrelevant questions, etc.) Positive attitude can include focus on the problems, smiling, clapping, similar hand gestures, and positive reminders about his work.

Total: 7.5/9

2 1/2 pts
~~2 pts~~
 child did not show signs of positive reinforcement

Rubric for Part II: Response in a Stressful Situation

	1	2	3
Accuracy	The child was unable and unwilling to solve the puzzle.	The child put forth observable effort to solve the puzzle and was able to get at least 25% of the shapes in the box.	The child was able to complete 75% of the puzzle successfully, with minimal help.
Ability to Solve	Observations show that the child was unsure of how to solve the puzzle, therefore reluctant in doing so. He did not ask for assistance or help and gave up when trying to solve.	Observations show that the child was unsure of how to solve the puzzle but asked for assistance in doing so. Despite having a hard time, he was not willing to give up when solving.	Observations show that the child was eager and focused on solving the puzzle. He either did not need help or was not afraid to ask for it when needed. He noticed the attributes of each shape and this affected his decision of which hole to put it in. He remained attentive on the task.
Emotional Response	Observations show that the child would get frustrated and/or disengaged when attempting to solve the puzzle. He became distracted and lost interest when trying to solve. The child showed signs of giving up and was unable to complete the puzzle while doing so.	Observations show that the child would initially get frustrated when trying to solve, but never showed signs of distraction or disengagement. Upon receiving guidance from the assessor, the child is no longer in a frustrated state and continues to persevere through the puzzle. The child demonstrates a positive attitude throughout most of the process, such as a willingness to try, and positive self-reinforcers such as clapping, telling himself he did a good job, phrases such as 'yay' or 'I did a good job', or anything similar (as noted in the observations).	Observations showed positive attitudes throughout the process, even when struggling with the puzzle. He persevered through the problem and never showed signs of disengagement (such as distraction, looking around the room, asking irrelevant questions, etc.) Positive attitude can include focus on the problems, smiling, clapping, similar hand gestures, and positive reminders for himself such as 'yay', 'I did it', and the like (as noted in observations). 2 1/2

Total: 8.5/9

focused on
problem but did
not show much
positive reinforcement

Scoring for Part III: Guardian Questionnaire

Each question can receive a total of three points. If the guardian circled A., that question earns 3 points. If the guardian circled B., that question earns 2 points; if the guardian circled C., that question earns 1 point. The maximum score that can be earned is 30 points.

1. 3 points
 2. 3 points
 3. 3 points
 4. 2 points
 5. 3 points
 6. 2 points
 7. 3 points
 8. 2 points
 9. 3 points
 10. 3 points
- Total: 26 ²⁷ points

Cumulative Score for Assessment

Add up the total points for each part to find the cumulative score. The maximum score is 48. At least an 80% demonstrates high self-efficacy; anything below a 60% demonstrates low self-efficacy.

pre :

$$\begin{array}{r} 26 \\ 17.5 \\ 8.5 \\ \hline 42/48 = 88\% \end{array}$$

post:

$$\begin{array}{r} 27 \\ 9 \\ 9 \\ \hline 45/48 = 94\% \end{array}$$

Appendix B

Lesson Plan 1

"For a preschool student, self-efficacy can be a powerful factor in the initiation of learned behaviors. High self-efficacy will be measured through various behaviors, such as retrying a task if failed the first time, performing behaviors modeled by the educator with little to no guidance, and recognizing accomplishments they have made through verbal and nonverbal cues. Nonverbal cues could include clapping for themselves, smiling, laughing, or dancing. Low self-efficacy will be measured through acts of giving up, negative self-talk, and shying away from tasks that may seem difficult to them."

<p>LESSON TITLE: Squash the Numbers</p> <p>GRADE LEVEL: Pre-K</p>	<p>SUBJECT AREA: Math</p> <p>TIME ALLOCATION: 15-20 minutes</p>
<p>CENTRAL FOCUS: Identifying numbers</p> <p>RATIONALE FOR TEACHING: <i>An essential prerequisite to entering kindergarten is being able to identify numbers by their quantity and symbol. In this lesson, I use a combination of visual and interactive art to help a student recognize numbers by counting them and relating them to the symbol they represent.</i></p> <p>LEARNING OBJECTIVES ALIGNED WITH STANDARDS:</p> <p>By the end of this lesson , the student will be able to identify numbers 1-9 by their corresponding symbols.</p> <p>By the end of this lesson, the student will be able to count numbers chronologically to identify the total quantity a number represents.</p> <p>By the end of this lesson, the student will interact with the art tools provided to identify a number and relate it to the art being made.</p> <p>MEASURABLE GOALS/TARGETS (with active verbs):</p> <p>The student will be able to identify numbers 1-9 by their symbol with at least 80% accuracy, being able to identify 8 out of the 9 total numbers.</p> <p>The student will be able to communicate what each number represents by counting the number of paint dots on each number with at least 80% accuracy, identifying 8 out of the 9 total quantities of each number being represented.</p> <p>After completing numbers 1-4 with assistance, the student will be able to count and identify numbers 5-9 independently or with help asked for explicitly by the student.</p> <p>HOW WILL SLO BE COMMUNICATED WITH STUDENTS?</p> <p>SLO's will be communicated with the student by explicit explanation of the activity as well as through scaffolded assistance during the activity.</p> <p>STANDARDS:</p> <p><i>Math Standards</i></p> <ol style="list-style-type: none"> <i>Identify and name numerals 1-9</i> <i>Demonstrate one-to-one correspondence when counting objects up to 10</i> <i>Understand that the last number spoken tells the number of objects counted</i> 	

Visual Art Standards

- i. *K.1PR Demonstrate willingness to try new processes.*
- ii. *K.2PR Explore a variety of materials and tools to create works of art.*
- iii. *K.3PR Communicate an idea using the elements of art.*

STRATEGIES FOR SELF-EFFICACY BUILDING ARE HIGHLIGHTED THROUGHOUT LESSON PLAN

***Reminder:** Utilize the observation record sheet to assess behaviors of self-efficacy throughout this activity, as defined on the sheet and in each lesson plan.*

SCOPE AND SEQUENCE**ANTICIPATORY SET/OPENER:**

Before transitioning into the main activity, review numbers 1-9 with the student. This can be done with teddy bear counters (or fingers if manipulatives aren't present). Using the numbers prepared (refer to materials/resources in right column), ask the student if they can identify the number that represents the teddy bear counters just counted. Use the teddy bear counters for numbers 1 through 9, but **only ask the student to identify a couple of the numbers just counted. Keep the prepared numbers out of sight unless asking the student to identify them.**

TRANSITION:

Explain to the student that we are going to figure out what each number represents using paint. Ask the student if he knows what paint is; talk about how it makes him feel if so. Answer any questions he may ask. Bring out the first prepared number and ask him what he thinks we are going to do with it.

Note any observations you may see from his behavior: is he curious about the paint or the prepared number? Does he feel it, touch it, look at it? Does he ask questions about it?

LEARNING SEGMENT

1. Begin by pulling out the first number. **Ask him what he thinks we are going to do with it** (avoid bringing out number 1 or 2 first because there will only be one paint dot on it, so it may not be as telling as to what the purpose of the activity is).
 - a. **If he is right about what is going to happen, praise him!**
 - b. If he is wrong about what is going to happen but gives a good guess, praise him for trying.
 - c. If he doesn't take a guess at all, encourage him to do so and praise him when he does.
2. Regardless if he is correct, repeat the instructions. The student will count each paint dot as he 'squishes' it to find the total number of dots, which is represented by the number he is squishing the paint dots on.

TIME ALLOCATIONS:

Opener: 5 minutes

Learning Segment: 10-15 minutes

STUDENT GROUPING:

Individual (but can be adjusted for small group or whole group)

MATERIALS/RESOURCES:

-Prepared numbers*:

1. 9 sandwich baggies
2. 18 pieces of printer paper (Including 9 for extension)
3. Numbers 1-9 on 9 pieces of printer paper, small enough to fit in sandwich bag
4. Assorted colors of non-toxic acrylic paint

-Paint brushes (for extension)

INSTRUCTIONAL STRATEGIES AND LEARNING ACTIVITIES:

-Frequent feedback and communication with student to encourage independent thinking, reflection, and engagement

-Visual art to teach math

-Interactive activity to stimulate senses

ACADEMIC VOCABULARY, LANGUAGE FUNCTION, LANGUAGE DEMANDS:

-Numbers 1 through 9

3. Before squishing the dots, ask the student what number he thinks the prepared number is.
 - a. Praise him if he is correct or if he tries but is wrong. If he refuses to guess, encourage him to and praise him when he does.
 - b. Extension: If he gets the number right after just looking at it, ask him how many dots he thinks are on the number without counting them.
4. Proceed to counting the total number of dots. Then, ask him 'what must this number be then?' 'Why do you think that?'
 - a. Praise him for any answers he gives but guide him in the right direction if he is wrong. Be sure to remind him that it is okay to make mistakes!
5. Repeat steps 1-4 until all numbers are completed.
 - a. Extension: If time allows, encourage the student to paint some of the numbers he sees and counted.
 - b. Accommodation: If the student appears to be struggling with relating the dots counted to the corresponding number, model the process with him. Bring back past numbers that have already been 'squished' and ask him to recall these numbers.
 - c. Additional accommodation: If student seemed to struggle in the opening activity, complete the learning segment with the numbers in chronological order.

ASSESSMENT PLANS:

-Formative throughout lesson; observations will be recorded in observation record sheet to identify any actions of self-efficacy, engagement, and ability to meet targets and objectives.

* To make prepared numbers, cut out or print a stencil of numbers 1 through 9. Each number must be large enough to put paint dots on but small enough to fit in a sandwich bag snugly. Using the paint, put the corresponding number of dots on each number. For example, one paint dot on the number one, two paint dots on the number two, etc. Spread them out on the number as much as possible. Then, carefully place the number with paint dots on it in the sandwich bag and seal it. Do this shortly before the lesson plan so that way the paint does not dry beforehand.

DIAGNOSTIC ASSESSMENT (Discuss post-teaching plans based on assessment data collected to inform future teaching)

Student was engaged in lesson, but not challenged. Recognized all #'s; in future should be taught 10-20. Saw correlation between # symbol and number of dots on symbol. Enjoys painting/tactile learning; shown in his eagerness to paint after 'squishing' the dots. Continue using art as a means of learning.

REFLECTION (Think deeply, carefully, and purposefully about the overall lesson presentation, including the planning (pre-presentation), pace of the lesson and its affect on the progressive flow of the learning, and the impact of formative assessments throughout):

During the presentation I chose to sit next to [redacted] as opposed to across from him. I feel that this took away from my ability to direct the flow of the

lesson; I didn't look at him when communicating as much. I also pulled out all of the #'s at once rather than 1 at a time which distracted him; he began trying to squish all of them. The lesson also went faster than expected, so having the extension helped to keep him learning and engaged. Because of this activity being tactile, he seemed to respond well to modeling activities.

REFLECTION (Same as above but focus only on your strategy presentation/learning segment, both the preparation for and presentation of)

I feel that this strategy is great for teaching students numbers because of the visual correlation between dot/symbol. Though [redacted] was not challenged, he responded well to that method by his immediate recognition of the correlation between # of dots and Symbol. In the future, this may work better with thicker paper; the numbers got

crumbled easily in sandwich bag. Dots may also be better distributed through a pipette, as squeezing the bottle on the number got a bit sloppy; making it harder to distinguish the dots.

Appendix C

"For a preschool student, self-efficacy can be measured through independent initiation of learned behaviors. High self-efficacy will be measured through acts such as retrying a task if failed the first time, performing behaviors modeled by the educator with little to no guidance, and recognizing accomplishments they have made through verbal and nonverbal cues. Nonverbal cues could include clapping for themselves, smiling, laughing, or dancing. Low self-efficacy will be measured through acts of giving up, negative self-talk, and shying away from tasks that may seem difficult to them."

Key for Behaviors	RT: retrying a task initially failed
	PB: performing behaviors modeled
	RA: recognizing accomplishments they have made
	GA: gave up on task
	NS: Negative self-talk
	SA: Shying away from a task they find difficult

Time	Behavior	Comments
3:00	curiosity	Asked me as I pulled out soon number- are there 2 dots on there? for the number 2 (familiar w/ #'s 1-9)
3		tried to touch paint dots before activity began
3	PB	pulled paint numbers out of bag I had them in, mimicking what I was doing to prepare for activity
3:05	inquisitive	When asking him what he thinks we will be doing, gives guesses correctly-recognizes correlation b/w dots and number
3:07	engaged	asked to paint numbers without being prompted (w/ the extension)
3:10	RA	After painting, said, 'Look, Ever! look at what I did!'

Appendix D
'Number Squishing' Activity



Appendix E

Lesson Plan 2

"For a preschool student, self-efficacy can be defined as the independent initiation of learned behaviors. High self-efficacy will be measured through various behaviors, such as retrying a task if failed the first time, performing behaviors modeled by the educator with little to no guidance, and recognizing accomplishments they have made through verbal and nonverbal cues. Nonverbal cues could include clapping for themselves, smiling, laughing, or dancing. Low self-efficacy will be measured through acts of giving up, negative self-talk, and shying away from tasks that may seem difficult to them."

LESSON TITLE: Build-a-Number	SUBJECT AREA: Math
GRADE LEVEL: Pre-K	TIME ALLOCATION: 15-20 minutes
<p>CENTRAL FOCUS:</p> <p>Independent recall of numbers 1 through 9 and demonstrating correspondence of quantity to symbol</p> <p>RATIONALE FOR TEACHING: <i>Being able to identify the relationship between quantity and number symbol is essential for beginning numbers before entering kindergarten. In this activity, the student will identify quantities by their number, then use a variety of art materials to recall and create that number. It is an extension of the first lesson plan in this study, as it encourages the student to recall number symbols introduced in the last exercise. To further advance his kindergarten readiness, he will begin practicing how to create those numbers beyond the traditional means of just writing (although we will be practicing that as well).</i></p> <p>LEARNING OBJECTIVES ALIGNED WITH STANDARDS:</p> <p>The student will be able to count objects and recognize the last object counted as the total number of objects for numbers 1-9.</p> <p>The student will be able to recognize the symbol that represents the total number of objects for numbers 1-9.</p> <p>The student will be able to represent number symbols 1-9 using a variety of art materials.</p> <p>MEASURABLE GOALS/TARGETS with active verbs);</p> <p>By the end of this lesson, the student will be able to relate the number of objects counted to the number symbol it represents with 80% accuracy.</p> <p>By the end of this lesson, the student will be able to identify number symbols and create them using a variety of art materials he chooses with 80% accuracy in identifying and creating each number.</p> <p>Throughout this lesson, the student will guide himself in coming up with his own methods of creating each number using the materials provided for at least 7 out of the 9 numbers created*.</p> <p>HOW WILL SLO BE COMMUNICATED WITH STUDENTS?</p> <p>The SLO's will be communicated throughout the activity through explicit explanation of the activity as it occurs as well as modeling and scaffolding as necessary.</p> <p>STANDARDS:</p> <p>Math standards:</p>	

- i. Identify and name numerals 1-9.
- ii. Demonstrate one-to-one correspondence when counting objects up to 10.
- iii. Understand that the last number spoken tells the number of objects counted.

Visual art standards:

- i. K.2CR Engage in self-directed play with various materials.
- ii. K.1CR Explore environments and experiences to generate original art-making ideas.

*Time may not allow for all numbers to be created, so this measurement can be modified as necessary as long as the majority of numbers are created at his discretion.

STRATEGIES FOR SELF-EFFICACY BUILDING ARE HIGHLIGHTED THROUGHOUT LESSON PLAN

Reminder: Utilize the observation record sheet to assess behaviors of self-efficacy throughout this activity, as defined on the sheet and in each lesson plan.

SCOPE AND SEQUENCE

ANTICIPATORY SET/OPENER:

Using number cards, ask the student to identify the number on each card for numbers 1-9 (extension: try 10 if you'd like as well). Pay attention to the numbers he struggles to identify. For these numbers, you can use the prepared numbers in lesson one to see if he can make any connection between those and the ones he sees on the cards.

Accommodation: Use bear counters if necessary to count the number being represented on the card.

TRANSITION: If using the bear counters in the opener, begin the learning segment by asking how many bear counters he sees. Explain to the student that you will be using these materials (refer to the materials listed in the resources) by showing him them to create the number.

LEARNING SEGMENT #1

1. (If you already had bear counters out as mentioned in the accommodation of the opener and transition, skip this first step initially but follow it when repeating these steps) Explain to the student that he is going to pull out bears from the cup until you say 'stop!'. Then, allow him to pull out bear counters. As you repeat this process later, make sure to not allow him to pull out the same number of bears twice.

2. Ask him if he knows what that number looks like (the total number of bears he pulled out).

a. Extension: Ask him to draw it first.

b. Accommodation: Show to him three different number cards and ask him to identify which number is being represented by the bear counters.

c. Be sure to praise him once he finds the right number and reassure him when he is wrong.

TIME ALLOCATIONS:

Opener: 5 minutes

Learning Segment: 10-15 minutes

STUDENT GROUPING:

Individual (can be modified for small group or whole group)

MATERIALS/RESOURCES:

- Paper
- Piper cleaner
- Glue stick
- Tape
- Non-toxic paint
- Paintbrushes
- Markers
- Crayons
- Scissors
- Newspaper (to lay materials on)
- Number cards
- Counting manipulatives

INSTRUCTIONAL STRATEGIES AND LEARNING ACTIVITIES:

- Independent learning
- Scaffolding
- One-to-one correspondence
- Exploration of materials

ACADEMIC VOCABULARY, LANGUAGE FUNCTION, LANGUAGE DEMANDS:

- Numbers 1-9

3. Referencing the different materials, ask him what materials he would like to use to create the number on the sheet of paper (placed in front of him). Make sure he is the one picking out the materials.

a. Take notes on how he reacts to this process. Is he hesitant to choose his own materials? Does he explore all of them, or pick the first one he sees? Does he explore how he plans to create this one the sheet of paper? For example, if he chooses to make the number with pipe cleaner, does he realize he needs tape or glue to connect it to paper? Or if he chooses paint does he realize he needs a paint brush?

4. At this point, let the student work independently. If he is showing signs of stress or confusion in creating the number, guide him as necessary.

Observe how he reacts to this assignment: is he engaged? Is he working confidently on his own? If he needs help, is he asking for it?

a. Accommodation: It may be necessary to draw a stencil of the number to help guide the student in creating it.

5. Repeat this process a few other times if possible. Make sure that he gets the opportunity to work with bigger and smaller numbers that vary in symbols, such as 1 and 8 (because 1 involves drawing lines and 8 involves drawing circles).

ASSESSMENT PLANS:

Formative; observations will be noted in observation record sheet to assess completion of objectives as well as response to positive feedback and will be later assessed as it relates to study.

DIAGNOSTIC ASSESSMENT (Discuss post-teaching plans based on assessment data collected to inform future teaching)

Based on what was observed, [redacted] was able to meet the measurable goals. He was able to identify the number symbol that represented the # of unit cubes pulled from the cup each time. He did need to be shown the number symbol, and painted symbols similar to the correct form, but illegible to a stranger. Strategies such as tracing may help; nonetheless he can identify symbol. Does not know tripod grasp;

REFLECTION (Think deeply, carefully, and purposefully about the overall lesson presentation, including the planning (pre-presentation), pace of the lesson and its affect on the progressive flow of the learning, and the impact of formative assessments throughout):

Overall, I was much more successful in this lesson than in my prior. I forgot to read through the first lesson enough to have each step memorized, including accommodations/extensions. This time was different, and it allowed me to help [redacted] get a better understanding of the activity. The time allotment was just enough; however, we only got through 4 numbers instead of 9 (which I

should have anticipated). I did not stencil the numbers that he painted which I would have liked, but this was his first time drawing # symbols free hand so I was surprised they were even a resemblance

is not yet comfortable with it

REFLECTION (Same as above but focus only on your strategy presentation/learning segment, both the preparation for and presentation of)

I think I was much more organized and thoughtful in this lesson as opposed to my last. I considered the fact that he may not know how to use a paintbrush (which he chose to use) & used the 6-step modeling process to teach him. I also witnessed each strategy mentioned in the plan:

- independent learning: ^{picking # of cubes from cup + answering MC w/ different number cards} use of
- Scaffolding: guiding w/ ^{use of} paintbrush; hand motion to indicate brush stroke for each number
- one-to-one correspondence: making connection b/w # of cubes and symbol it represents
- exploration of materials: he was able to identify all materials, but quickly chose paint

Appendix F

"For a preschool student, **self-efficacy** can be measured through independent initiation of learned behaviors. High self-efficacy will be measured through acts such as retrying a task if failed the first time, performing behaviors modeled by the educator with little to no guidance, and recognizing accomplishments they have made through verbal and nonverbal cues. Nonverbal cues could include clapping for themselves, smiling, laughing, or dancing. Low self-efficacy will be measured through acts of giving up, negative self-talk, and shying away from tasks that may seem difficult to them."

Key for Behaviors	RT: retrying a task initially failed PB: performing behaviors modeled RA: recognizing accomplishments they have made GA: gave up on task NS: Negative self-talk SA: Shying away from a task they find difficult ID: Independently exploring materials C: Demonstrating curiosity regarding lesson
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Time	Behavior	Comments
	ID	Explored materials: I brought out- 'These are markers' 'What are these?' 'I want to use the paint' (referring to colored pencils)
	PB	I used '6 step modeling' modified to show how to use paint brush and he demonstrated behavior very well
	RT	After drawing '2', I asked if he thought it looked like the 2 on the cards. He said no, and independently tried again
	RA	When he drew '7' I smiled, said, 'good job!' and his response was smiling and bobbing up+down in seat
	C	After lesson, he asked me lots of questions about the next ones: "Will there be paint?" "Will it be more fun than paint?"

asked to perform job I was doing, which was putting paint out. I let him and he did a great job

When drawing '4', he closed the top (4) when I asked him the difference

between the one shown and ⁴⁶ ~~was~~ he noticed
DEVELOPING SELF-CONSCIOUSNESS Y QS being an upphase
and ~~explained~~ ~~that~~ Y QS being an upphase
justifying his choice shows that he is
confident in his decision, even if it is wrong

RA

After activity, I allowed him to continue painting, and he did so independently, demonstrating the modeled behavior for changing colors/pouring paint. He said to himself 'pretty good' while painting

N/A

Decided to paint rainbow on own; recognized each color in order; had to ask leading questions for some... 'What comes next...'

created audible reminders for himself when switching paints => 'dip' (in water)

'dry' (to dry brush), 'flip it over' (referring to drying other side of brush)

Appendix G
'Build-a-Number' Activity



Appendix H

Lesson Plan 3

"For a preschool student, self-efficacy can be defined as the inner strength to initiate or persist in the initiation of learned behaviors. High self-efficacy will be measured through various behaviors, such as retrying a task if failed the first time, performing behaviors modeled by the educator with little to no guidance, and recognizing accomplishments they have made through verbal and nonverbal cues. Nonverbal cues could include clapping for themselves, smiling, laughing, or dancing. Low self-efficacy will be measured through acts of giving up, negative self-talk, and shying away from tasks that may seem difficult to them."

LESSON TITLE: The Finger Stamp	SUBJECT AREA: Math
GRADE LEVEL: Pre-K	TIME ALLOCATION: 15-20 minutes

CENTRAL FOCUS: Beginning concepts of addition & more/less than

RATIONALE FOR TEACHING: *As the third lesson plan in this series, we move into a broader understanding of addition as it is supported in Ohio's Early Learning & Development Standards. It is essential part of kindergarten readiness that children begin learning concepts of addition, subtraction, and comparison, such as how to do it as well as why we do it. These concepts are already intertwined with essential everyday activities, therefore the goal of this activity is to help them do it intentionally.*

LEARNING OBJECTIVES ALIGNED WITH STANDARDS:

By the end of this lesson, the student will be able to solve addition problems, with totals smaller than 8, by counting.

By the end of this lesson, using finger stamps as a mode of creating art, the student will be able to describe what the art represents when solving beginning concepts of addition problems, as well as begin familiarizing himself with subtraction concepts.

By the end of this lesson, as the student creates the finger stamp art, the student will be able to describe the steps he takes to make the art.

MEASURABLE GOALS/TARGETS with active verbs);

The student will be able to accurately add two groups of finger stamps together for at least ²~~3~~ out of ³~~4~~ of the sets.

The student will be able to describe the process of creating stamp art when prompted with 100% accuracy.

The student will be able to guide himself in creating this art and use his understanding of counting to determine the totals when adding, explicitly asking for help when needed. He will also be open to beginning concepts of subtraction and comparing.

HOW WILL SLO BE COMMUNICATED WITH STUDENTS?

The SLO's will be communicated throughout the lesson plan as guided instruction while performing these activities.

STANDARDS:

Math standards:

- a. **STANDARD STATEMENT:** Count to solve simple addition and subtraction problems with totals smaller than 8, using concrete objects.

Visual Art standards:

- b. K.2RE Describe processes used to make art.
c. K.3RE Observe and describe works of art.

STRATEGIES FOR SELF-EFFICACY BUILDING ARE HIGHLIGHTED THROUGHOUT LESSON PLAN

Reminder: Utilize the observation record sheet to assess behaviors of self-efficacy throughout this activity, as defined on the sheet and in each lesson plan.

SCOPE AND SEQUENCE

ANTICIPATORY SET/OPENER: Using a strategy he's previously worked with, use the bear counters and have him pull some from a cup (no more than 5). Then, you pull some from a cup (less than 5). Then, put the two groups together and have the child count the total number of bears. Try this a couple times. As an extension, you could take two away and ask him how many there are now.

TRANSITION: Bring in the materials that you will be using for finger stamping. Ask the student what he thinks we will be doing with these materials; allow him to explore these materials, especially if they are unfamiliar to him. Then, explain to him what we will be doing by showing him; press your finger to the ink pad and put your fingerprint in one square one the piece of paper*. Then let him do it.

LEARNING SEGMENT #1

1. Instruct the student to add finger stamps in each cloud (or heart or star). Between the two clouds in each group, do not exceed 8. Any time he wishes to change ink color, wipe his finger off with rubbing alcohol and a cloth. Note: *Make sure to guide him when finger stamping to ensure that he does not stamp them too close together or on top of each other.*
2. After doing this, ask him the following questions:
 - a. How many fingerprints do you see in the first square?
 - b. How many fingerprints are in the second?
 - c. How many fingerprints are there all together?
 - d. Extension: If the student is understanding these concepts, try exposing him to concepts of subtraction. For example, ask 'If we take away two fingerprints from the first group, how many will we have left?' and cover up two fingerprints, having him count the remaining.
 - e. Additional extension: If the student is catching on to concepts of addition and subtraction well, ask him questions of more/less than. For example, 'Which square has more fingerprints?' or 'Which square has less?'

Note: Keep the two other groups covered until it is time to put fingerprints in them if necessary.

3. Repeat step 1 for the next two groups.
 - a. Extension: Create groups that equal greater than 8 if the child is catching on easily.

TIME ALLOCATIONS:

Opener: 5 minutes

Learning Segment: 10-15 minutes

STUDENT GROUPING:

Individual (can be modified for small or whole group instruction)

MATERIALS/RESOURCES:

-Non-toxic ink (different colors)
-Rubbing alcohol & cloth (to clean finger off when switching colors)
*

-Bear counters
-Cup

INSTRUCTIONAL STRATEGIES AND LEARNING ACTIVITIES:

-Scaffolded assistance
-Questioning
-Interactive Art
-Independent learning

ACADEMIC VOCABULARY, LANGUAGE FUNCTION, LANGUAGE DEMANDS:

-The concept of addition & subtraction
-The concept of comparison
-More than/less than
-Numbers 1-8

ASSESSMENT PLANS:

-Formative; observations will be made throughout the lesson in observation record sheet

DEVELOPING SELF-EFFICACY

ask more specific questions but got right answers so what did you use? How did you do this?

4. At the end of this activity, ask him some reflective questions:

- How did you make it?
- What did you need to make it?
- What different colors do you see in this art?
- Do the colors in this art remind you of anything?
- How does this art make you feel?

regarding his understanding as well as signs of self-efficacy.

Happy Why? 'Be there the colors of the rainbow'

Note: This exercise should be completely self-guided aside from the prompted questions. Help may be necessary but note if he asks for it. Be sure to give regular praise when he gets the right answer and reassure him when he gets the wrong answer. Observe: When he comes across a tough problem, does he persevere or give up?

He does not give up, but does want guidance 'looks at me and goes quiet when lost/confused'

DIAGNOSTIC ASSESSMENT (Discuss post-teaching plans based on assessment data collected to inform future teaching)

He was showing a beginning understanding of addition, but I had to use words like 'how many do you see altogether?' I also had to point to them as he counted, which was a strategy he also picked up. 3/3 he got correct when adding; got lost at concept of subtraction (I tried w/ unifix cubes). Tried to do 'more than' w/ 10s but didn't understand, but understood when I said 'which has more red?'

REFLECTION (Think deeply, carefully, and purposefully about the overall lesson presentation, including the planning (pre-presentation), pace of the lesson and its affect on the progressive flow of the learning, and the impact of formative assessments throughout):

Overall, the planning went well; however, I did not account for the mess that would be made on the child's shirt/hands. In future, make sure to get consent from guardian. The pace went well and the transition was effective; we finished in about 20 mins. picked up quickly the concept of addition; however needed guidance w/ finger pointing and needed simplified sentences (didn't understand 'altogether'); consider adding modified sentences as accommodations in future.

REFLECTION (Same as above but focus only on your strategy presentation/learning segment, both the preparation for and presentation of)

I think it was easy for me to execute this lesson with an overall idea of its purpose; however, it was easy for me to oversee important details, such as the extensions, accommodations, and posing questions. (He didn't really need accommodations though). I think it would help for me to create a few goals for myself to be more thorough in my lesson plan (i.e. I will make sure to...)

How did you do this? + painted

red?

responded well to reflection questions; continue using in lessons for

metacognitive practice

the targets were met, but he was not explicit when asking for help, he more so would just look at me. ~~There~~ I noticed a similar form of nonverbal communication when asking reflection questions; ~~but not~~ he would answer questions, but not w/ his words.

REFLECTION (Same as above but focus only on your strategy presentation/learning segment, both the preparation for and presentation of)

I think my presentation was probably the best I've done; I was very hands off, asking guiding questions but encouraging him to use the materials on his own. My questions were simple and explicit - I could tell by the ease in his ability to respond. If he struggled to respond, I would modify my words so he would understand. My plan was easy enough to follow while doing the plan, but in the future I should give my eyes less of a search when looking for key questions I want to ask; i.e. w/ bullet points.

Appendix I

"For a preschool student, self-efficacy can be observed through independent initiation of learned behaviors. High self-efficacy will be measured through various behaviors, such as retrying a task if failed the first time, performing behaviors modeled by the educator with little to no guidance, and recognizing accomplishments they have made through verbal and nonverbal cues. Nonverbal cues could include clapping for themselves, smiling, laughing, or dancing. Low self-efficacy will be measured through acts of giving up, negative self-talk, and shying away from tasks that may seem difficult to them."

Key for Behaviors	RT: retrying a task initially failed PB: performing behaviors modeled RA: recognizing accomplishments they have made GA: gave up on task NS: Negative self-talk SA: Shying away from a task they find difficult ID: Independently exploring materials C: Demonstrating curiosity regarding lesson
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Time	Behavior	Comments
	C	I bring a bag for my materials each time we do a lesson; this time he opened up my bag on his own and saw ink pads and asked, 'are we going to be stamping?'
	C	When setting up, he asked 'what are we going to use stamps?' I said no; what do you think we will be using? 'he said, 'our fingers?'
	recognized my mistake	I was pulling out unitix cubes and thought I pulled out 6 but pulled out 5; when I asked him 'how many' he said 5, I told him he was wrong + he said 'Actually Ms. Eves, it is 6!'
	C	After working together the 1st time to count cubes then stamp them, he realized the process and did it on his own
	RA	After he recognized which heart had more stamps he said 'good job!' and he threw up a high five and smiled

RA

Appendix J
'Finger Stamp' Activity



Appendix K

Lesson Plan 4

"For a preschool student, self-efficacy can be defined as the belief in one's ability to initiate or sustain the initiation of learned behaviors. High self-efficacy will be measured through various behaviors, such as retrying a task if failed the first time, performing behaviors modeled by the educator with little to no guidance, and recognizing accomplishments they have made through verbal and nonverbal cues. Nonverbal cues could include clapping for themselves, smiling, laughing, or dancing. Low self-efficacy will be measured through acts of giving up, negative self-talk, and shying away from tasks that may seem difficult to them."

LESSON TITLE: Count the Squares	SUBJECT AREA: Math
GRADE LEVEL: Pre-K	TIME ALLOCATION: 15-20 minutes

CENTRAL FOCUS: Comparing groups of objects & addition/subtracting them

RATIONALE FOR TEACHING:

As the fourth lesson plan in this series, it is important that the student continues to build their understanding of what addition, subtraction, and comparing groups looks like before entering kindergarten. This can lay a strong foundation of understanding in terms of its purpose and how it is done before introducing any formal vocabulary for it. By creating a lesson plan that involves comparing colors as well, we are also introducing beginning concepts of algebra and patterns. This is the next strand in Ohio's Early Learning & Development Standards.

LEARNING OBJECTIVES ALIGNED WITH STANDARDS:

By the end of this lesson, the student will be able to use comparisons of color to add and subtract.

By the end of this lesson, the student will be able to start identifying groups that are larger and smaller in quantity than others through comparisons.

By the end of this lesson, the student will be able to share his personal opinions of his art as well as that of others.

MEASURABLE GOALS/TARGETS with active verbs);

The student will be able to find the total number of squares when adding with 80% accuracy.

As an extension, the student will attempt to find the total number of squares when subtracting with 50% accuracy.

The student will be able to compare the different colors of squares to find which color has the most squares with 80% accuracy.

The student will be able to effectively communicate his opinions on the art created by both himself and the teacher.

The student will explore the materials given to him to determine how to create art with them, asking for help when needed.

HOW WILL SLO BE COMMUNICATED WITH STUDENTS?

The SLO's will be communicated with the student throughout the lesson plan through a mixture of prompts, feedback, and guided questioning.

STANDARDS:

Math standard:

- STANDARD STATEMENT:** Identify whether the number of objects in one group is greater than, less than or equal to the number of objects in another group up to 10.
- STANDARD STATEMENT:** Count to solve simple addition and subtraction problems with totals smaller than 8, using concrete objects.

Visual Art standard:

- K.3CO Share personal responses to works of art and acknowledge the opinions of others.
- K.2CR Engage in self-directed play with various materials.

STRATEGIES FOR SELF-EFFICACY BUILDING ARE HIGHLIGHTED THROUGHOUT LESSON PLAN

Reminder: Utilize the observation record sheet to assess behaviors of self-efficacy throughout this activity, as defined on the sheet and in each lesson plan.

SCOPE AND SEQUENCE

ANTICIPATORY SET/OPENER:

1. Begin by showing the student the materials that we will be working with (the tissue squares, construction paper, glue). Ask the student what they think we will be doing with them. After gathering some ideas from the student, and being sure to praise any answers they give, explain to them that you will be putting the squares on the construction paper. Ask them how do they think we will do that? If they answer correctly (with glue) praise them! If not, reassure them and show them the glue. Ask them if they know what it is, and if not, explain it to them and show them how we use it by demonstrating- glue a piece of tissue paper on the construction paper. Encourage him to do so as well. Glue, at most, 8 pieces of tissue paper on yours and be sure that the student does the same. Make sure that the student knows he can glue them however he would like, but make sure he does not glue them on top of each other.

TRANSITION: After both of you have glued all the tissue paper on the construction paper, ask the student to count how many squares are on the construction paper. Then, have him count how many are on your piece of construction paper.

- Extension: Have the child write the total number of squares on the construction paper.
- Accommodation: You write the total number of squares on the construction paper.

LEARNING SEGMENT #1

1. Ask the student- what do you think of your work? What do you notice about it? *Observe- do you have to ask him more specific questions to get an answer out of him* (such as, 'what kind of colors do you see?' and 'what shape is this?' etc.)

2. Ask the student whose piece of art has more squares on it.

- Be sure to praise any right answers and reassure as well as guide

TIME ALLOCATIONS:

Opener: 5-10 minutes

Learning Segment: 10 minutes

STUDENT GROUPING:

Individual (can be modified for small or whole group instruction)

MATERIALS/RESOURCES:

-glue
-Construction Paper
-Red and blue tissue paper (or any two colors) cut into squares; no more than 50 total squares & create an uneven color ratio of squares

INSTRUCTIONAL STRATEGIES AND LEARNING ACTIVITIES:

-Interactive Art
-Guided questioning
-Scaffolding

ACADEMIC VOCABULARY, LANGUAGE FUNCTION, LANGUAGE DEMANDS:

-More than/less than

-Numbers 1-9

-Concepts of addition & subtraction

ASSESSMENT PLANS:

-Formative; observations will be made throughout lesson in

the student to the correct answer.

3. Now, focus on his piece of art. How many red squares are on his piece of paper? How many blue squares? Are there more blue squares or red squares?

a. Be sure to praise any right answers and reassure as well as guide the student to the correct answer.

4. Ask the student how many squares are on the sheet of paper in total. Pay attention- does he count them again? Or does he refer to the number on the piece of paper if it was written? If it was not written, does he remember how many there are without having to count?

4. Extension: Ask the student- if we take away all the red squares, how many will be left? See if he can find this out on his own. It may be necessary to help him. Pay attention- does he ask for help before you have to step in?

a. As always, be sure to praise any right answers and reassure him if he gets them wrong. Help guide him in the right direction, and pay attention to see how this affects his engagement with the lesson and his willingness to solve the problem.

observation record sheet and recorded below that pertain to his understanding of the standards as well as his self-efficacy skills.

DIAGNOSTIC ASSESSMENT (Discuss post-teaching plans based on assessment data collected to inform future teaching)

Child was able to count up to 14; when I used terms "more" he understood, which he has not previously. He correctly identified the # of squares on his art & mine, but when I pointed to them. When he pointed he would skip ahead of himself and count more numbers. When doing extension he accurately answered how many are left; I used words like 'if we hide

REFLECTION (Think deeply, carefully, and purposefully about the overall lesson presentation, including the planning (pre-presentation), pace of the lesson and its affect on the progressive flow of the learning, and the impact of formative assessments throughout):

Overall, I think this lesson was successful. It worked well to practice counting and adding as well as comparing + subtracting. This was the 1st lesson I followed exactly; reading the lesson as I performed it. Though it seemed I included every part of the lesson, it is unrealistic to do that in the classroom.

I think my planning for this went well bc it left a lot up to the child and he responded well to open-ended questioning. He paused often to think of his answers. The pace of the lesson went smooth; however it only took 10 min beginning to end

all the purple squares, how many are left?

Appendix L

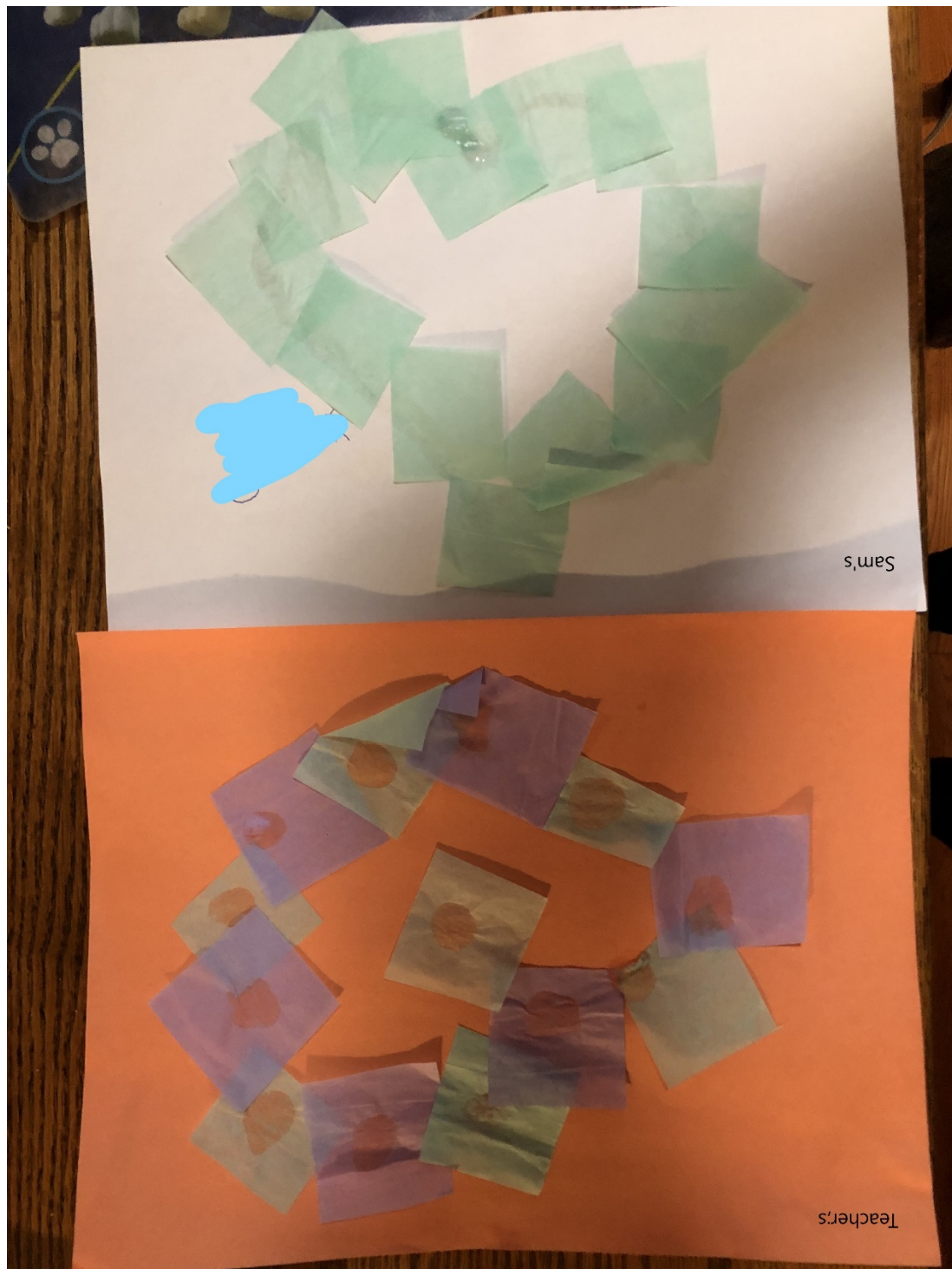
"For a preschool student, **self-efficacy** can be measured through independent initiation of learned behaviors. High self-efficacy will be measured through such as retrying a task if failed the first time, performing behaviors modeled by the educator with little to no guidance, and recognizing accomplishments they have made through verbal and nonverbal cues. Nonverbal cues could include clapping for themselves, smiling, laughing, or dancing. Low self-efficacy will be measured through acts of giving up, negative self-talk, and shying away from tasks that may seem difficult to them."

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Time	Behavior	Comments
	C	At the beginning of activity, he asked what was in envelopes (squares)
	ID*	When looking @ materials, recognized glue and demonstrated how to use it; explained how to use it as well; looked @ materials and when asked 'what do you think were going to do?' was right
	RA	At end of lesson, he got up and said 'high five' after I said his art looked awesome (very enthusiastic high five; he wound up)
	Creating new ideas / asked for help	After I modeled gluing squares, he came up with the idea to draw a heart w/ the glue + asked for help drawing it (did hand over hand)
	PB	After seeing me glue square, repeated step w/o prompt

	"I don't know, I really just don't know" [↑]	He had 15 squares but could only count to 14, then said "booby" when I asked him if he really knows what comes next, he said
	Justification w/o prompt	When asking which work has more squares he correctly said his and explained w/o me having to ask him to

Appendix M
'Count the Squares' Activity



ASSESSMENT ON SELF-EFFICACY FOR THE PRESCHOOL AGED CHILD WITH A FOCUS ON MATHEMATICAL CONCEPTS

"For a preschool student, self-efficacy can be defined as the independent initiation of learned behaviors. High self-efficacy will be measured through various behaviors, such as retrying a task if failed the first time, performing behaviors modeled by the educator with little to no guidance, and recognizing accomplishments they have made through verbal and nonverbal cues. Nonverbal cues could include clapping for themselves, smiling, laughing, or dancing. Low self-efficacy will be measured through acts of giving up, negative self-talk, and shying away from tasks that may seem difficult to them."

Early Learning Content Standards Covered in Assessment

- Domain: Cognition and General Knowledge
 - Sub-domain: Mathematics
 - Strand: Number Sense
 - STANDARD STATEMENT: Count to 20 by ones with increasing accuracy.
 - STANDARD STATEMENT: Identify and name numerals 1-9.
 - STANDARD STATEMENT: Identify without counting small quantities of up to 3 items. (Subsidize)
 - STANDARD STATEMENT: Demonstrate one-to-one correspondence when counting objects up to 10.
 - STANDARD STATEMENT: Understand that the last number spoken tells the number of objects counted.
 - STANDARD STATEMENT: Identify whether the number of objects in one group is greater than, less than or equal to the number of objects in another group up to 10.
 - Strand: Number relationships & operations
 - STANDARD STATEMENT: Count to solve simple addition and subtraction problems with totals smaller than 8, using concrete objects.
 - Strand: Algebra
 - STANDARD STATEMENT: Recognize, duplicate and extend simple patterns using attributes such as color, shape or size.
 - STANDARD STATEMENT: Sort and classify objects by one or more attributes (e.g., size, number).

Name of child: _____

Date: 9/29/21

Time: 5:00 pm

Note: It is important when performing these tests that you do nothing to reinforce or discourage any behaviors. This assessment is designed to observe the child's behavioral and emotional response when faced with complex tasks, specifically in math. The goal of this assessment is to show improvements in the child's self-efficacy after using art to teach mathematical concepts related to the standard statements above.

Part I: Math Concepts

→ Follow each prompt below with the child. You will need at 10 manipulatives (see Appendix A) and two cups. In the section titled 'notes' below each prompt, record the child's response as well as observations made as they solved the problem. If they ask for help, give it to them, but make sure to record that. If they show any emotions, verbally or nonverbally, record this as well. Do not give the child any answers, and do not give them any praise or feedback. Use the rubric at the end of this document to analyze and score this section of the assessment.

- * Before starting activity, child opened Unifix cubes without my knowledge. ⁶² ² ^{it's} ^{connected} ^{some} ^{asked} ^{me} ^{to} ^{count} ^{on} ^{said} ^{good} ^{job} ^{when} ^I ^{got} ^{it} ^{right}
- DEVELOPING SELF-EFFICACY
1. Ask the child if they know how to count to 20. Then, have them demonstrate.
 - a. Notes: Counted to 20 w/ ease
Said yes, then
 2. Using the cards at the end of this document, ask the child to identify each number. Make sure to cover up all numbers except the one being identified if you show them on a single sheet.
 - a. Notes: Identified up to 9 correctly
 3. Create 4 separate groups of manipulatives. Place 1 manipulative in the first group, 3 manipulatives in the second, 2 manipulatives in the third, and 3 manipulatives in the fourth. Ask the child to count the number of manipulatives in each group.
 - a. Notes: Counted each and recognized each group w/o having to count them individually by pointing
 4. In a cup, place 10 manipulatives. Ask the child to count each manipulative in the cup. It may be necessary to guide them in this, such as demonstrating taking a manipulative out one at a time to count them. As a follow up, after counting all of the manipulatives, ask, "so how many are there in total?"
 - a. Notes: Counted all of them w/ ease; I got stuck together and he counted them as two
 5. Create two groups of manipulatives. One will have 5 manipulatives, and one will have 8. Ask the child which group has more manipulatives.
 - a. Notes: Said correct answer w/o individually counting them; I asked how do you know that & he explained by counting the larger group; when I asked why that one has more he counted smaller groups
 6. Create two groups of manipulatives, one that has 2 manipulatives and one that has 4. Ask the child how many are in the first group, then ask how many are in the second. Finally, ask how many manipulatives there are in total.
 - a. Notes: Answered correctly, then combined and found total w/o guidance

Part II: Response in a Stressful Situation

- Have the child solve a shape puzzle (see Appendix B). Explain to the child that they need to get all of the blocks into the box. If the child asks for help, give it to them, but make sure to write this in the note section below. Observe how they react when they get stuck on a shape; how they react when they successfully get a shape in the box; if they ask for help; if they identify the shapes; if they give up; how they respond when they succeed, and any other observations regarding emotional response or dependency/independency when solving the task. Visit the rubric at the bottom of this document to score this part of the assessment.

o Notes:

Solved puzzle w/ significant ease; he was stuck on a couple but knew to rotate cube to try other holes. Initially he would say 'yes' or 'yay!' but became more quiet as it got more challenging. There was 1 he was struggling w/ but he explicitly asked for help: 'Ever can you help me with this?' He had it in the right hole but needed to rotate it. There was another one, same circumstance, but rather than explicitly asking he said, 'I can't figure this one out.'

blue indicates change in response from pre-assessment*

Part III: Guardian Questionnaire

→ This part of the assessment will be completed by the child's primary caregiver(s). If given to multiple caregivers, have them complete this separately and at the same time so they do not share or disclose their answers with each other.

Guardian: With each prompt, circle the response most applicable to your child.

1. My child can brush their teeth on their own.
 - ☒ a. Yes, without prompt.
 - b. Yes, but I have to encourage them/put toothpaste on their toothbrush.
 - c. No, I have to brush their teeth for them.
2. My child can get dressed on their own.
 - ☒ a. Yes, my child can get dressed without assistance.
 - b. Yes, but I have to and supervise.
 - c. No, I have to help them get dressed.
3. My child can use the toilet without assistance.
 - ☒ a. Yes, my child knows to use the bathroom and I do not have to assist.
 - ☒ b. Yes, but I have to guide and help them as necessary.
 - c. No, my child does not yet use the toilet.
4. My child likes to try new things, such as new activities or food.
 - a. Yes, my child is always willing to try new things, even if they are nervous to do so.
 - ☒ b. Yes, but it takes a lot of persuading sometimes.
 - c. No, my child gets angry or frustrated when encouraged to try new things.
5. My child is friendly around people they do not know.
 - ☒ a. Yes, my child will initiate conversations with new people.
 - b. Yes, but I must guide my child to talk to new people.
 - c. No, my child is completely shy around new people.
6. My child will persevere through a challenge, despite any troubles they may face.
 - a. Yes, my child tries to work through any hard task they may face, even if they become frustrated with the process.
 - ☒ b. Yes, my child will persevere through most challenges, but if it does not keep his interest he will give up.
 - c. No, my child avoids any tasks or challenges that are too hard for him.
7. My child likes to learn new things, whether prompted or if it is something he finds interesting.
 - ☒ a. Yes, my child is often willing to learn new things.
 - b. Yes, but I must encourage him.
 - c. No, my child does not often like to learn new things.
8. When coming home from daycare, my child initiates conversations about what he did during the day.
 - a. Yes, my child frequently talks about his day at school.
 - ☒ b. Yes, but I typically have to ask specific questions about his day to learn more about it.
 - c. No, my child seldom talks about his day at school.
9. Overall, I feel that my child displays high self-confidence at home and in school.
 - ☒ a. Yes, my child is confident in who he is.
 - b. Yes, but he can be shy in unfamiliar situations and around new people.

- c. No, I would say that my child is not very confident.
10. Overall, I would say that my child learns a lot through exploration.
- a. Yes, I see my child to be an independent learner.
 - b. Yes, but my child must be encouraged to explore.
 - c. No, my child does not learn independently and through exploration.

RUBRICS

Rubric for Part I: Math Concepts

	1	2	3
Accuracy	The child responded with the correct answer to at least 2 questions.	The child responded with the correct answer to 3-4 of the questions.	The child responded with the correct answer to 5-6 of the questions.
Ability to solve	Observations show that the child struggled in solving at least some problems and was reluctant to do persevere. He did not ask for help when solving.	Observations show that the child struggled to solve some problems but was willing to ask for help. He worked through the problems despite having difficulty in solving them. He noticeably put forth effort to try to solve the problems.	Observations show that the child asked for help as needed or did not need help. He was eager/more than willing to solve each problem and looked forward to the next. He took time in trying to solve each problem, especially those he found challenging.
Emotional Response	Observations show that the child was frustrated and unmotivated to solve the problems. Nonverbal and verbal cues show that difficulty solving problems led to distraction and negative attitudes, such as anger, frustration, and disengagement.	Observations show that the child would get noticeably frustrated when solving problems, but his attitude would shift when getting help. When he solved a problem correctly, he would demonstrate positive reinforcements, such as clapping, telling himself he did a good job, phrases such as 'yay' or 'I did a good job', or anything similar (as noted in the observations).	Observations showed positive attitudes throughout the process, even when struggling with a problem. He persevered through the problems and never showed signs of disengagement (such as distraction, looking around the room, asking irrelevant questions, etc.) Positive attitude can include focus on the problems, smiling, clapping, similar hand gestures, and positive reminders about his work.

Total: 9/9

Rubric for Part II: Response in a Stressful Situation

	1	2	3
Accuracy	The child was unable and unwilling to solve the puzzle.	The child put forth observable effort to solve the puzzle and was able to get at least 25% of the shapes in the box.	The child was able to complete 75% of the puzzle successfully, with minimal help.
Ability to Solve	Observations show that the child was unsure of how to solve the puzzle, therefore reluctant in doing so. He did not ask for assistance or help and gave up when trying to solve.	Observations show that the child was unsure of how to solve the puzzle but asked for assistance in doing so. Despite having a hard time, he was not willing to give up when solving.	Observations show that the child was eager and focused on solving the puzzle. He either did not need help or was not afraid to ask for it when needed. He noticed the attributes of each shape and this affected his decision of which hole to put it in. He remained attentive on the task.
Emotional Response	Observations show that the child would get frustrated and/or disengaged when attempting to solve the puzzle. He became distracted and lost interest when trying to solve. The child showed signs of giving up and was unable to complete the puzzle while doing so.	Observations show that the child would initially get frustrated when trying to solve, but never showed signs of distraction or disengagement. Upon receiving guidance from the assessor, the child is no longer in a frustrated state and continues to persevere through the puzzle. The child demonstrates a positive attitude throughout most of the process, such as a willingness to try, and positive self-reinforcers such as clapping, telling himself he did a good job, phrases such as 'yay' or 'I did a good job', or anything similar (as noted in the observations).	Observations showed positive attitudes throughout the process, even when struggling with the puzzle. He persevered through the problem and never showed signs of disengagement (such as distraction, looking around the room, asking irrelevant questions, etc.) Positive attitude can include focus on the problems, smiling, clapping, similar hand gestures, and positive reminders for himself such as 'yay', 'I did it', and the like (as noted in observations).

Total: 9/9

Scoring for Part III: Guardian Questionnaire

Each question can receive a total of three points. If the guardian circled A., that question earns 3 points. If the guardian circled B., that question earns 2 points; if the guardian circled C., that question earns 1 point. The maximum score that can be earned is 30 points.

1. 3 points
 2. 3 points
 3. 3 points
 4. 2 points
 5. 3 points
 6. 2 points
 7. 3 points
 8. 2 points
 9. 3 points
 10. 3 points
- Total: 26 ²⁷ points

Cumulative Score for Assessment

Add up the total points for each part to find the cumulative score. The maximum score is 48. At least an 80% demonstrates high self-efficacy; anything below a 60% demonstrates low self-efficacy.

pre :

$$\begin{array}{r} 26 \\ 17.5 \\ \hline 80.5 \end{array}$$

$$42/48 = 88\%$$

post:

$$\begin{array}{r} 27 \\ 9 \\ \hline 9 \end{array}$$

$$45/48 = 94\%$$