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Science in Early Childhood Education

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The Importance of Science in Early Childhood Education

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A Capstone Project for the Bachelor of Arts in Human Development and Family Studies

Introduction

Science is often limited or absent in an early education classroom. It is important to give children an outlet to experience science in the classroom or through lesson plans. Having science at an early age can provide children the opportunities to build up their reasoning, to question things about the world, and later in life to feel more confident in other STEAM (science, technology, engineering, art, and math) activities or areas. To address this need, I created a 3-day program for 3 to 5 year-olds at Little Learners of Aptos School in Aptos, California.

Needs Statement

Preschool programs often lack focus on science activities, especially in play-based programs. It's important for children to engage in science at a young age, because it paves the way for children to have a more positive attitude towards science and other STEAM areas of learning. Because science often involves children telling the teacher what they want to learn, teachers may avoid implementing science-related activities since it seems counter to traditional instructor-led play. By incorporating an inquiry-based approach to lessons, children can gain the ability to form patterns, theories, and building knowledge (McClure, 2016). For teachers to understand that children have the capacity to comprehend big concepts but might need a little scaffolding to retain the larger idea, large possibilities in early childhood education would be opened. When children are learning science in the classroom, " rather than being viewed as the memorization of facts, science is seen as a way of thinking and working toward understanding the world."(Lind, Ph.D., 1998, as cited in McClure, 2016) Some children, however, might get the basic framework of the more in-depth science areas but still might have some misunderstandings about the actual concept. In a study reported by William Philips (1991), He discovered that

children during the lesson contained the information of the Earth being a sphere but later in the interviews of the second graders some still believed that the Earth was flat (Smolleck & Hershberger, 2011). That study showed that children are sometimes able to retain only some of the information they're taught, but may understand the idea or concept much better. When teachers integrate not only scientific facts into the classroom, but concepts, it will help the children see the answers from these two different perspectives. In a preschool classroom, it may be more effective to combine the real world and the scientific world to create a concept for a child to make a rational discovery (Smolleck & Hershberger, 2011). For example, a teacher could have a part of the classroom to be a designated science area that is always open to the children during the day to initiate learning.

Processes that educators can apply to their classrooms to help the integration of science are broken up into two approaches, informal learning and structured learning. An informal learning experience is when the educator teaches unplanned in the classroom, involving the naturistic experience, or when spontaneous situations arise during play that can create opportunities to learn about the world. Structured learning experience is when the educator is pre-planning lessons with the curriculum in mind for the children (Lind, Ph.D., 1998). Educators that want to add science into the classroom but want their program to stay play-based can start by having a science area in the classroom and change themes and materials that children are free to look at and use whenever they would like to. Teachers adding this to their classroom can give children the opportunity to explore on their own and ask the teacher questions about the curriculum to make it a teachable moment about science, using informal or naturalistic learning.

Children at this age are beginning to use the scientific process to inquire about the world. Students use the basic process and the integrated process combined, to not only help the child

explore their own ideas but also new ones (Martin, Jean-Sigur, & Schmidt, 2005). When children are using the basic process the child is using skills such as sorting and classifying, observing and measuring (Martin, Jean-Sigur, & Schmidt, 2005). They can use one or many of these skills at once, and shows they are processing the information and also exploring it from new perspectives. For example, when the child is measuring they are looking at something's length, volume, weight, temperature, and time (Martin, Jean-Sigur, & Schmidt, 2005). When a child is using this process they are able to ask more questions and gain more information from their teachers and peers. When children are playing with water for example, it can be a great opportunity for the children to use lots of their investigation skills, also for teachers to use these investigation moments to ask questions that will help the children expand their learning (Martin, Jean-Sigur, & Schmidt, 2005).

Given that early science benefits preschoolers, I created a three-day lesson for 3 to 5-year-olds at Little Learners of Aptos Preschool, in Aptos, California. This will test if a science learning experience will be able to teach and engage children in early childhood education.

Theory

Piaget asserted that, as children learn more information, their understanding becomes more complex. Piaget's theory has three components: schemas, the adaptation process, and the stages of cognitive development.

Schemas in "Piaget's theory are the basic building blocks of intelligent behavior, a way of organizing knowledge" (Mcleod, 2018). When children are learning about the world, schemas can help them with the understanding of actions, objects, and abstract concepts (Mcleod, 2018). When children are using and applying these schemas, it is helping them make a mental

representation of the world using the information they already have to understand or make decisions in new situations (Mcleod, 2018). There are many different forms of a schema that can be used to make a model for understanding. The adaptation process is when intellectual growth is happening within children in new situations. This process happens through assimilation, accommodation, and equilibration of concepts along with use of existing schemas. A good example of accommodation is when a child has a fear of clowns and then is faced with a person that has similar features as a clown. The child must replace their schema of the clown and make it fit with this new idea that just because someone has similar features to a clown it does not make them one (Mcleod, 2018). When accommodation does not work, a need is changed to deal with a new situation and the progress of cognitive development occurs (Mcleod, 2018). Cognitive development is how children are learning fundamental concepts through their growth. Piaget has four areas of cognitive development 1. Sensorimotor: birth to 18-24 months 2. Preoperational: toddler 2-7 year olds 3. Concrete operational: 7-11 years old 4. Formal operational: adolescence to adulthood. Each child must and will experience each stage, although the rate and progress may vary (Mcleod, 2018). Combining adaptation and cognitive development is important, because throughout these processes, children are taking in new information and changing old ideas, while adopting new behaviors to better themselves for the world around them (Cherry, 2020).

This theory will be applied to the classroom and the science activity because children are already using schemas naturally in daily life. In my lesson, children will be able to expand their schemas in relation to leaves and the causes for their color change. Differences in how the children learn during the activity could show how far along they are in cognitive development stages.

Considering Diversity

My project will be presented to a class of about 9 to 10 preschoolers ranging from 3 to 5 years-old. From my observation as an employee at this site, the children are predominantly white, from middle to high-income homes, and most come to school 5 days a week. There are more girls than boys in this program. English is the predominant language of the children and families in this school. Participants who are not English proficient may be excluded from the project. This activity may work more effectively with older kids because it involves more scientific language and the children could actually execute the experiment themselves instead of watching a teacher do it so that they can be more involved with the process and be better engaged. The learning activity gives not only the reason and proof of why the leaves change colors but it can be something that the children can teach others and continue the growth of learning.

Learning outcomes

I am going to be delivering a daily 30 minute lesson for 3 days to a class of 6 to 9 children at Little Learners of Aptos Preschool, classroom ages 3 to 5.

By the end of the project, students should be able to:

1. Understand why leaves change colors
2. Identify what leaves have chlorophyll still in them
3. Identify different seasons by the color of trees leaves

Methods

Day 1:

To introduce the children to the project and main question, they were asked "do you know why leaves change color?" This was written out on a visual poster. I wrote down everyone's ideas so they can look at them as a class together and be recorded for the activity. Next, I read the book called *Summer Green to Autumn Gold: Uncovering Leaves' Hidden Colors* by Mia Posada, which explains why leaves change color. During the book, I asked the children questions to check on their understanding and attentiveness, such as "do you see the difference between these trees?", "can you remember why the leaves are green?"and questions focused on the word *chlorophyll,* by pausing before the word *chlorophyll,* and then children filled in the blank together orally. After the book, we looked at our list of ideas. We read through them again and talked about why some of the class ideas were on the right track. Lastly, they explored the yard as a group to collect leaves for the next day's experiment. See Appendix A.

Day 2:

I asked the children if they remember why leaves change color. I discussed and repeated the learning material with the class. I took out the collected leaves from day 1, laid them out, and asked them what leaves look like they have the most chlorophyll in them and what has the least. The children helped me sort through the leaves. Then, I led an experiment where the leaves were

each put into 4 test tubes and filled with rubbing alcohol. I explained to the class that rubbing alcohol is like a cleaning product that only adults can use. The leaves from the day before were boiled that night because there is no stove available at work, then I put them into tubes with the children watching. After, I asked the class their predictions and recorded the children's answers similar to the first day, with this question as "what do you think is going to happen to the leaves?" After the children made their predictions, I told them we will check the tubes after rest time to see if anything has changed. See Appendix B. Later that day we looked at the test tubes and the children noticed that the liquid had changed to the colors of the leaves.

Day 3:

On the last day, the children were presented with a picture/worksheet of a bare tree that says, "Can you show what a fall tree looks like?" I provided a variety of paper leaves available for them to glue on the tree branches like yellow, orange, and red. Then after that, I handed out another blank tree that prompted "Can you show what a summer tree looks like?" The children had different green leaves and blossoms to choose from this time. As the children were working on the art project, we talked about what colors were being used and why. I re-read the book from the first day to help the children review the concept as well. The children then compared their two pictures, and we talked about why the leaves are different colors and which ones still have chlorophyll. This activity will give the students a chance to visualize and process the difference between the two seasons. See Appendix C.

Results

Learning outcome 1 was to understand why leaves change colors. Before reading the book, I asked children "why do you think leaves change color?" and wrote down their ideas

about it. See Figure 1. After the learning activities, the children were able to answer the question of why leaves change color on later class days.

Learning outcome 2 was that the participants would identify what leaves still have chlorophyll in them. See Figure 2. The learning outcome was partially met because the older children were able to sort the leaves by the different colors, and also identify which leaves have chlorophyll during classes after the activities when asked. Younger children could also identify with some help, and all students remembered the term chlorophyll and that it related to leaves.

Learning outcome 3 was identifying different seasons by the color of the leaves. The children were able to express this by doing different pieces of artwork. Some children chose to put some of the Fall leaves at the base of the tree and others chose to put a few on the branches. Then, the children worked on the summer tree. Some chose to put flowers and leaves and others just chose leaves. See Figure 3. The children met this learning outcome because they all were able to call back to the book and remember why the trees look different in different seasons.

Discussion

This project was for the most part, successful. The children involved seemed to enjoy all the parts of the project and were very receptive to the information. During each learning outcome of the project, the children engaged with me and each other to increase their knowledge of the subject, whether on their own or with help. The learning outcome that the children probably could have used more time on was the science behind why leaves change color. The children are still bringing leaves to me and talking about what color it is and why it is like that. I also kept the test tubes in the classroom for the rest of the month, and the children were very interested in looking at them each day as the colors got darker. This does show interest in learning more about

the scientific concepts, which shows some successful retention after the project. The children are in the preoperational stage in Piaget's theory, and the children used their schemas in each stage of the project. For example, the children expanded their schemas by collecting leaves and conducting an experiment on their color.

If I were to do this again in the classroom I would likely change the experiment so the children can participate more. Maybe doing a leaf collection and organize them in groups so that the children can be more involved with each other during the experiment. Also, find a few more books to read about the science behind why leaves change color so the children can hear it in different ways and have a few different opportunities to learn that information. Overall, I do believe that the children were able to absorb the information successfully for their development stage and genuinely enjoy the learning experience.

References

Cabe Trundle, B. (2008). Teaching Science During the Early Childhood Years. In *National Geographic*. Retrieved 2020, from https://ngl.cengage.com/assets/downloads/ngsci_pro0000000028/am_trundle_teach_sci_early_child_scl22-0429a.pdf

Cherry, K. (2020). Adaptation In Piaget's Theory of Development. Retrieved November 14, 2020, from https://www.verywellmind.com/what-is-adaptation-2794815

Lind, Ph.D., K. (1998). Science in Early Childhood: Developing and Acquiring Fundamental Concepts and Skills. *Eric*. Retrieved 2020, from https://files.eric.ed.gov/fulltext/ED418777.pdf

Martin, D. J., Jean-Sigur, R., & Schmidt, E. (2005). Process-oriented inquiry—A constructivist approach to early childhood science education: Teaching teachers to do science. *Journal of Elementary Science Education, 17*(2), 13-26. doi:10.1007/bf03174678

McClure, E. (2016, November 30). STEM Starts Early: Grounding Science, Technology, Engineering, and Math Education in Early Childhood. Retrieved November 12, 2020, from https://eric.ed.gov/?id=ED574402

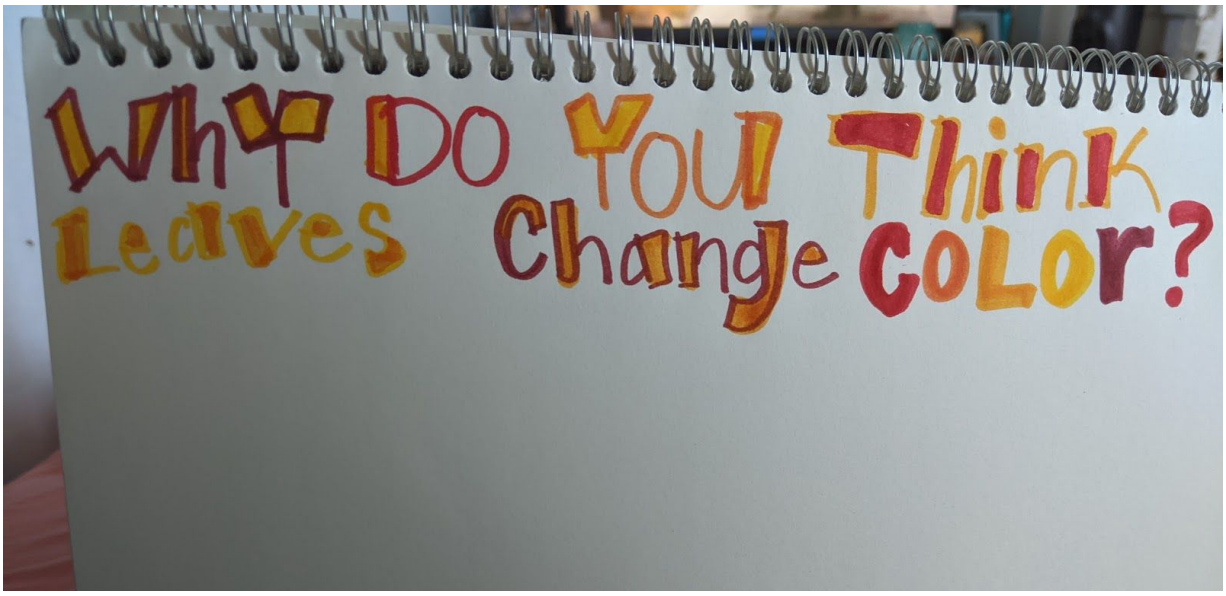
Mcleod, S. (2018). Jean Piaget's Theory and Stages of Cognitive Development. Retrieved September 27, 2020, from https://www.simplypsychology.org/piaget.html

Reynolds, A. J., & Walberg, H. J. (1992). A structural model of science achievement and attitude: An extension to high school. *Journal of Educational Psychology, 84*(3), 371-382. doi:10.1037/0022-0663.84.3.371

Smolleck, L., & Hershberger, V. (2011). Playing with Science: An Investigation of Young Children's Science Conceptions and Misconceptions. *Arizona State University*. Retrieved 2020, from https://cie.asu.edu/ojs/index.php/cieatasu/article/view/32 4/120

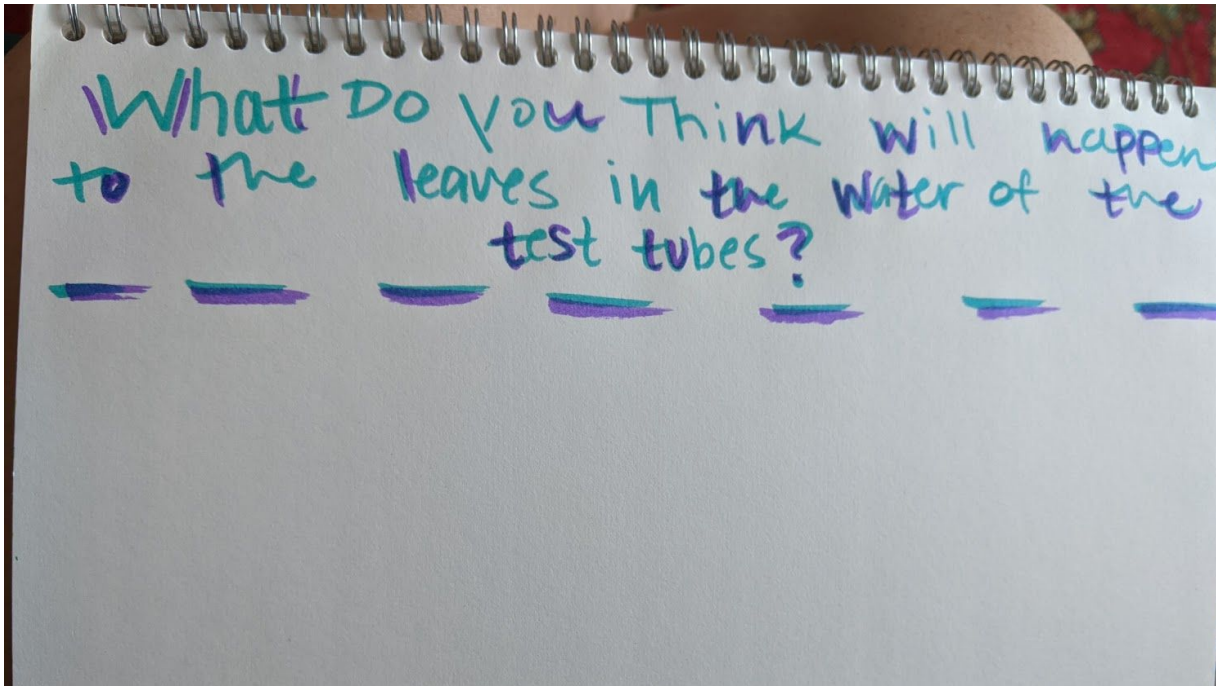
Appendix A

The chart for the children to tell me what they think is the reason leaves change color.



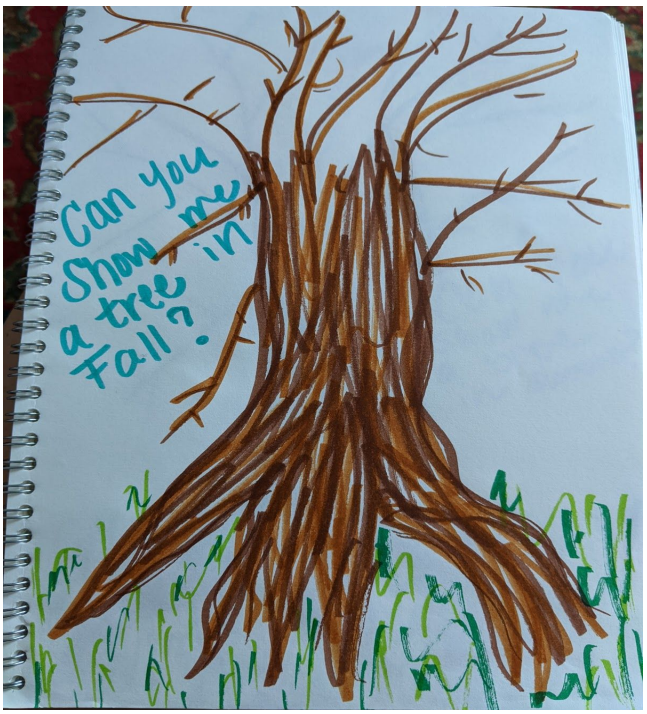
Appendix B

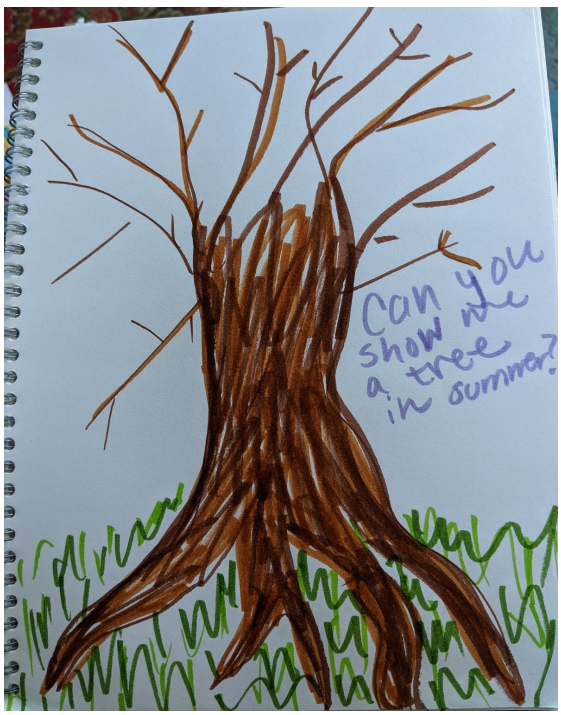
A chart for the children to predict what will happen in the test tube experiment



Appendix C

The art project that the students will work on to visualize the difference in season leaf color.





There will be different color leaves for the children to choose and glue onto their art project.

Figure 1:

The children's response to the Day 1 prompt

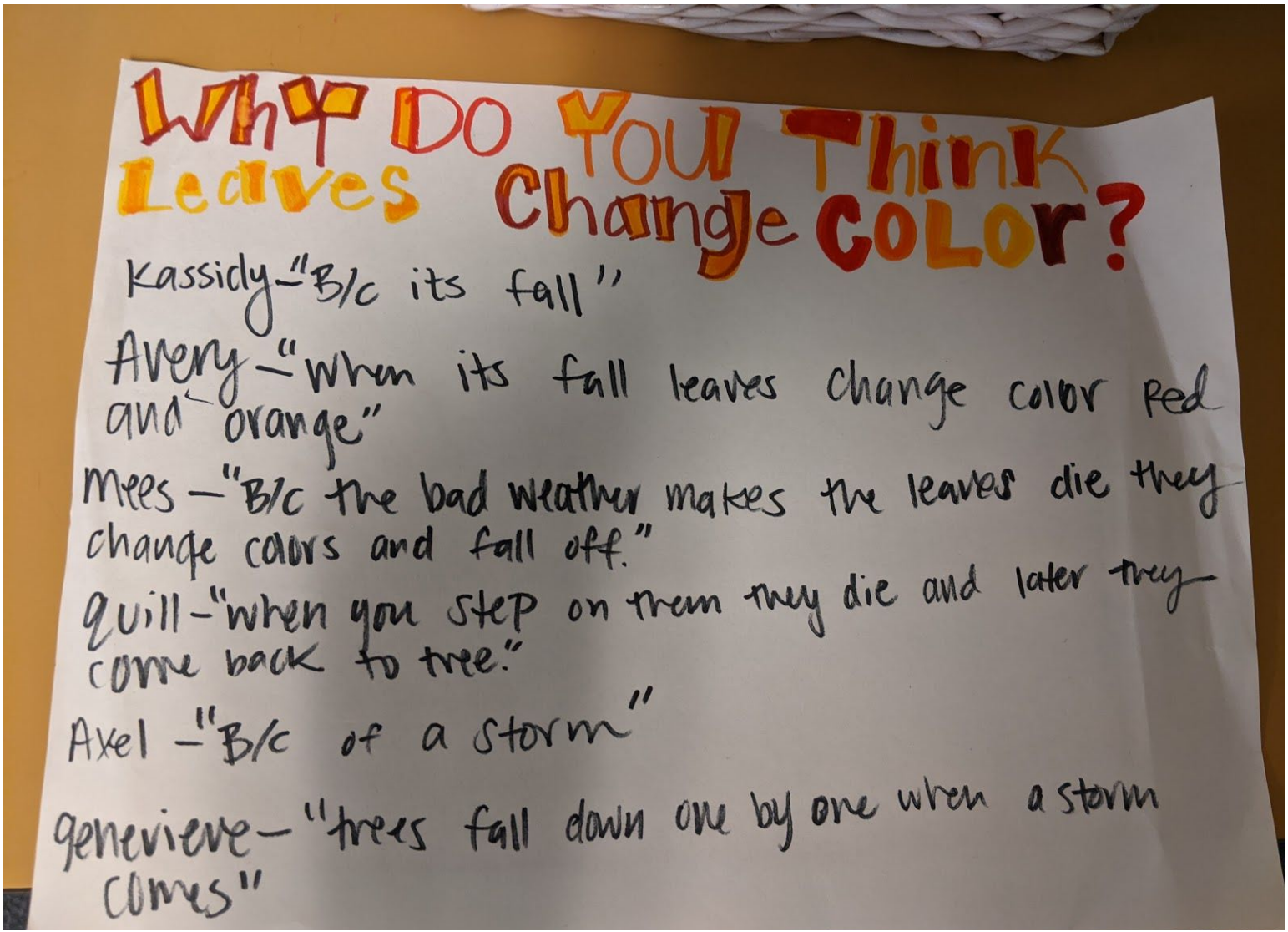


Figure 2

The children's predictions about what will happen during our experiment.

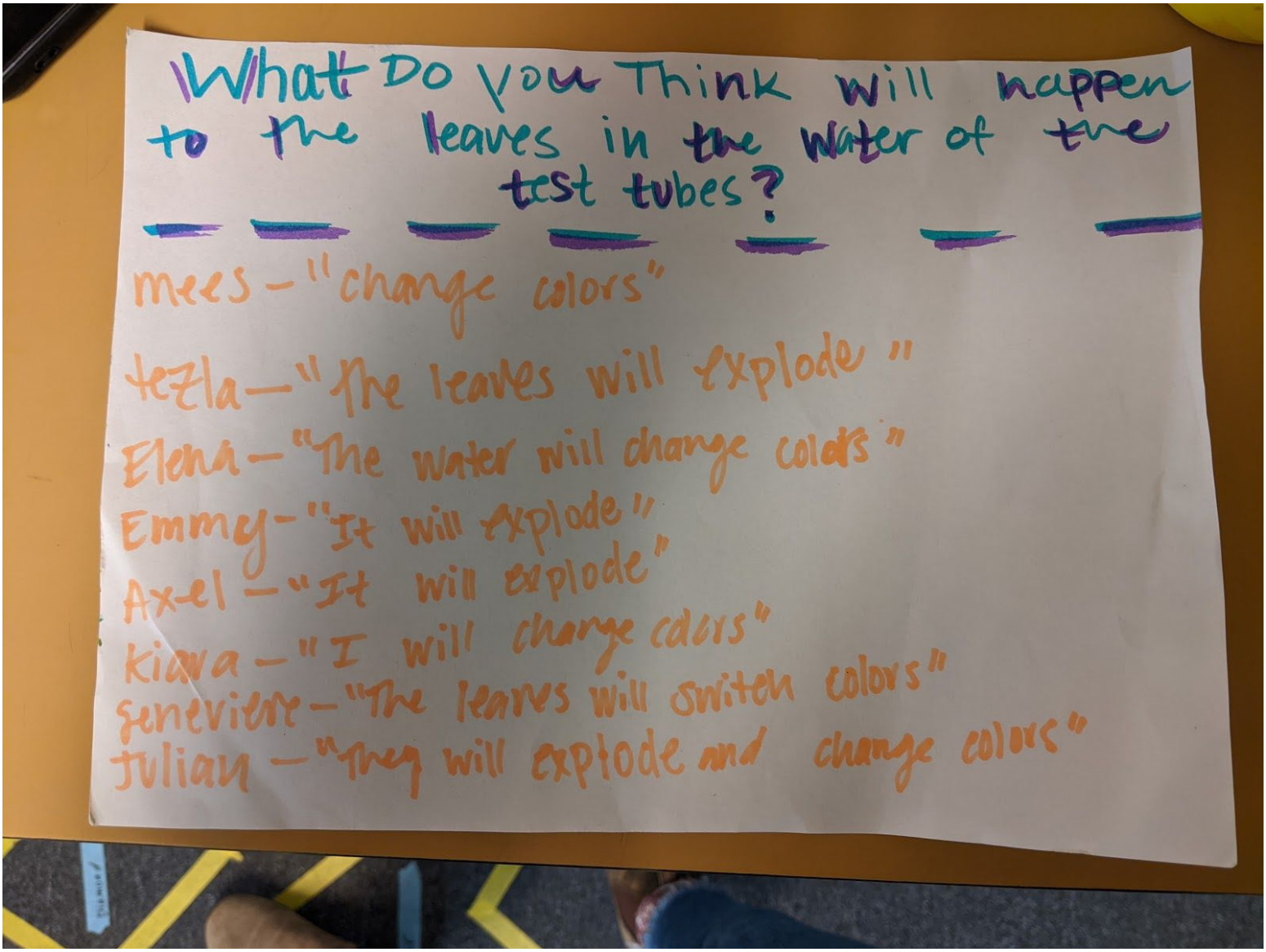
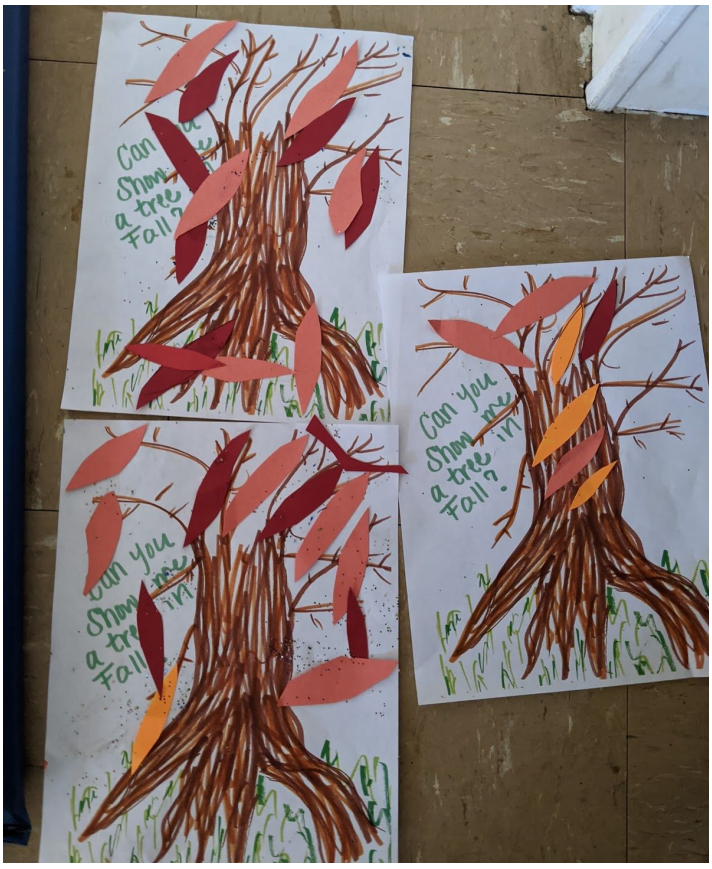


Figure 3

The children's art projects after they have chosen what leaves they want and how many leaves they would like on the tree.



Appendix D

Presentation from Capstone Festival

Science in Early Childhood Education

By Olivia Kocina

Needs Statement

- Science is missing from early education curriculum
- It can give children the skills for early problem solving and an outlet to ask questions about scientific discovery

Theory Applied

Piaget's theory of the natural progression of intelligence:

- Children(2-7 years old) are in the preoperational stage of learning and beginning to think symbolically
- Learning how to manipulate the symbols they already know

Learning Outcomes

Will children (3-5 years old):

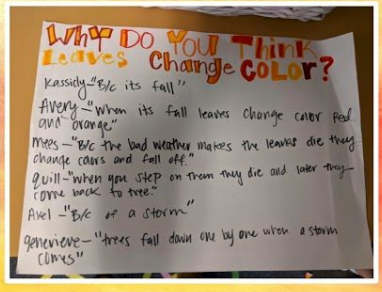
- Know why leaves change colors?
- Identify what leaves have chlorophyll still in them?
- Understand the differences between seasons by the color of leaves?

Methods

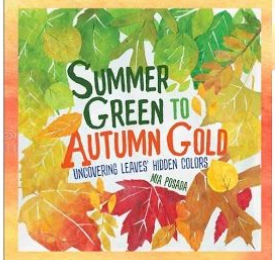
Day 1:

- I will ask **"why do leaves change colors?"** Answers will be recorded
- Book read to children explaining the science behind leaf change
- Children walk around yard to collect leaves for experiment

Answers given by children **before activities:**



- Explains the science behind why leaves change color
- New vocab for children **(chlorophyll)** and how it affects color change in leaves



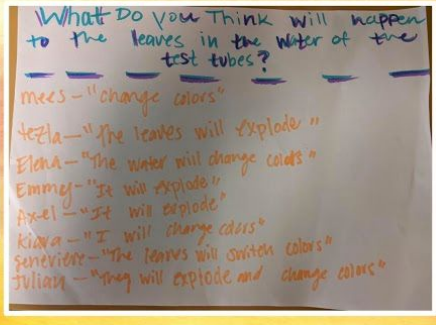
Day 1: Book reading session

Day 1: Leaf Collecting

Day 2:

- With collected leaves, children help conduct a test tube experiment to see a visual representation of leaves changing color
- Group asked **"What do you think will happen to the leaves?"** and answers recorded

Answers before **test tube experiment:**



Day 2: Science Experiment

Day 3:

- Children participate in an art project picking appropriate leaves for each season based on color
- Autumn and Summer used in project

Day 3: Art Activity

Summer Tree

Autumn Tree

Results

Learning outcomes **after activities**:

- All children retained and recalled the word chlorophyll
- Older children could explain why leaves change color and younger could with help
- The whole group could distinguish trees by season based on color of leaves

Did It work?

- For the most part, yes!
- Children learned some new vocabulary about the world around them and still discuss it in class
- Children seemed very engaged by activities and enjoyed it

Thank you for listening!

Any questions or comments?

Olivia Kocina