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Increasing Math in Preschool Curriculum

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A Bachelors in Science, Human Development and Family Science Capstone Project

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Introduction

In many preschools and early childhood educational settings, mathematical skill-building is lacking in the curriculum. With a lack of math curriculum in a preschool classroom, students may not have foundational mathematical skills, may lack problem-solving skills, and may lack self-confidence in math skills. To help children develop their math skills, I designed a virtual math activity for 3 to 4-year-old preschool children attending Monterey Peninsula College Early Childhood Lab School.

Needs Statement

Increasing math prevalence in the preschool curriculum is important for future academic growth. Currently, there is a low level of early math curriculum in preschool programs. While a preschool program may include math, it is rarely a focus of the curriculum and may not sufficiently help to advance skills to build on later. Those are shown in one study where 60% of 3-year-olds had no math activity in preschool (Clements, D). Early Math education is important

for academic achievement in later years including Kindergarten Readiness, increased test scores, lower the achievement gap, and increasing scores in the stem subjects.

Failure to teach or use math words in preschool education can lead to lower standards and lower academic achievement (Kibanoff et al.)   As Bailey D. states in the Article *why is it important to teach math in preschool?* "Failing to learn earlier skills disadvantages children trying to learn later skills" (2014),   This is because children learn skills in preschool that correspond to higher math abilities. One example is that children using single-digit math in preschools such as counting or simple adding and subtraction will still need to use single-digit arithmetic to do multi-digit arithmetic such as adding two-digit numbers or multiplication in higher grades. This is also true with sorting. Sorting skills will turn into classification skills in later math.   Also according to Kristy vanMarle an Associate Professor focusing on children cognitive research mentions in her interview with NPR that children who are behind the peers when they enter school remain behind in high school (Depenbrok, J)

Klibanoff et al. (2006) state that early differences in early childhood mathematics education can lead to higher academic achievement in later years. Having more math in the

preschool classroom is a strong indicator of reading achievement as well as overall academic achievements in letter grades.   Increasing math achievement also helps lower the school readiness gap across the socioeconomic spectrum. (Klemens, D 2013).   Klemens states that those children who are middle income still are underperforming compared to their wealthy peers. This changes if a high-quality math program is taught in preschool and follows through then even the low-income children will catch up if follow-throughs happen in the later grades.

In looking at the types of early math skill-building that can lead to later competence, Gray and Reeve (2014) point to counting, quantifying, and qualifying small items including sorting, in reaching higher early academic success.   These types of math skills can lead to higher reading comprehension which is also an indicator of higher academic achievements in letter grades (Klemens, D 2014), Therefore lower levels of math will contribute to lower levels of math and low reading and math scores in older grades.

Clements and Semana (2016) also found that early math skill-building in preschool is linked to higher subject interest and achievement in STEM subjects, as well as higher reading achievement. Therefore, children must learn math because, without mathematics knowledge, students' achievement in reading and STEM achievement and interest may be lower.

For my project, I will devise a 1-day virtual sorting activity via zoom for preschool children ages three to four. Where they will learn to sort by color and shape. My project will consist of reading a book via zoom aloud to the students that include words and visuals about sorting. Then I will provide sorting activities with the children, including sorting a group of objects one way (by color) and then using the same objects, sorting them a different way, by shape. My project will help to increase the cognitive skills of the children, including important sorting and grouping math skills for future mathematical problem solving and success.

Theory and diversity

Piaget's Theory of cognitive development is broken down into four general categories: Sensorimotor, Preoperational, Concrete Operational, and Formal Operation. Children age zero to 2 are in the Sensorimotor stage this state is where object permanence develops as well as coordination between sight and senses.   The preoperational stage starts at age two and goes to age seven, the preoperational stage says that preschool children use symbolic thinking, language becomes more advanced.   However, children still can not grasp more complicated activities like cause and effect as the mind is based "more on intuition than logical thinking" (Web MD).

Concrete operational thinking begins at age 7 and last go tell age 11. While the formal

operational stage is from age 11 tell adults. In the concrete operational stage, children start to

think more advanced about concrete objects or objects that seem not to change and are always

the same. Children in this stage understand conservation. (Cherry K (2020) & Web MD (n.d),

Children up to adults in the formal operational stage can do very abstract and logical thinking.

Preschool children are in the preoperational stage of Piaget's theory of cognitive

development.   The preoperational stage is when children learn to increase memory, learn

through symbolism but are not logical thinkers. (Pigate, 1964). Children in the preoperational

range have imagination, increased vocabulary but are not able to do reversible actions(Pigate

1964). Some older preschoolers may be able to think of some logic. Children's logic and

imagination as well as their developmental needs can be engaged and supported by gently

pushing the child in the right direction.   Children's logic and imagination can also be developed

by the teacher helping children find different ways to do a normal task. Sorting can start the

process of logic as sorting different objects into groups or areas by specific colors- red or shapes-

squares will help children mind grow. Sorting has also been shown to improve STEM skills in

future academics (Clemens & Semena, 2006). The subjects in STEM are all based on logic and

creativity as well as other parts of the mind as well in the future and come to more creative

sorting ideas like sorting by the stripe on a car.   Sorting is a type of classification, which is an

important mathematical skill in the future. The children learning sorting by different traits red

and blue as well as shapes will help them think abstractly in the future.

Consideration of diversity

I will be doing my project at the Monterey Peninsula Early Childhood Lab School (MPC

Lab School) for 4, 3-4-year-old children in the Garden Room classroom.   I would expect the

population to be representative of the larger lab school. As the MPC Lab School is a low-income

subsidized community preschool center with limited private pay options. The MPC lab school

includes children connected with MPC, CSUMB, and the local Monterey Bay community.   The

garden room classroom has 8 boys, 6 girls. Of the boys, seven were four years old and one was

three years old. Of the girls, one was three while the rest were four. Most of the kids speak a

second language. However, they all understand English (Ridgemaiden, M. Personal

Communication) therefore the project being in English will not be an issue for any of the

children. My project is inclusive of all children and can be adapted in different languages. Math

is important for all children especially those children who are lower-income and therefore more likely to be behind in older grades (Clements D). Teaching an early math project to the children is important for all children and will help the children who might be behind catch up in higher grades.

My Learning outcomes are the project are

1: Identify 2 similarities between blocks,

2: Identify 2 ways to sort by different traits,

3: explain how they sorted by different traits

Methods

When the children wake up from nap time and finish their snack, I will join a small group of 4 students pre-selected by the MPC Early Childhood Lab School to participate in the project. I will meet them by Zoom and ask them to sit in the block area. I will introduce myself and what I will be working on with them in the next few days, which is sorting objects by color, shape, and

how the object feels. I will ask them what they think sorting means and write their ideas on a whiteboard, which I can show them over Zoom. Next, I will read the book *The Button Box (Reid M, 1990)* to them over Zoom, checking to see if they understand by asking the children questions while reading (Appendix A).

I will document these answers on a chart (Appendix B). After reading the book, I will ask the children again, what ways they can sort objects, ex. by color, shape, or how it feels (Appendix C). I will excuse them to join their class. I will explain to the students that they will be doing a sorting activity at the tables.

The students will then go to the tables where the blue and red blocks will already be set up. I will ask the students to sort the blocks into the same color piles. I will then ask the students to re-sort one of their piles into a new way of sorting. Then I will ask the students to name how they re-sorted their blocks (by shape and/or texture). I, or a classroom teacher, will chart how the students re-sorted their objects. I will ask the students if they noticed how other classmates sorted their items, and if they noticed similarities and differences. Then i will dismiss the students to outside activities

Results

Learning Outcome 1

Learning outcome 1 which was to identify similarities between objects was met, children were able to identify different characteristics of what was same and different which all children saying this is a square and these are triangles.   1 child also mentioned that the triangle shapes were different and 2 mentioned that the two triangle shapes were different. (See Table 1)

Learning outcome 2

Partially mett. The kids were able to sort one way but only after an example was given but they were a bit distracted by building castles to sort it a second way.   (See Table B). all children were able to separate squares from blocks. But none of the children were able to do it in two ways or did not be interested in sorting a second way. They started building towers and castles instead, though we're still talking about what the blocks felt like or how they were the same or different. (See Table 2)

Learning outcome 3

Not mett.   While children were able to identify what was the same and different they were not able to explain that different trait, they were not able to describe it while connecting the two the material. (See Table 3).

Discussion

Overall I think this project went okay. The kids were not completely certain on what to do when I asked them to organize things by the same trait. I think I should have asked them more questions as they did seem to be able to understand how to sort without an example, even after reading the book.   However with an example then they did it well and started to talk about how it is alike and different. The other hard thing was for me to document the results as i couldn't hear the kids. I do think if I were to do this again I would definitely ask more questions and hopefully do this in person instead of via zoom so i could move around and ask questions. The other thing that was a bit challenging was the fact that it was hard for them to see the photos of the book without me directly holding it to the computer camera when I asked them to describe how the buttons were similar. The children had a good time playing with the blocks and wanted to continue after the time was over.   The problems that happened probably were due to children at first not understanding what I wanted. The second was when I asked them to resort they

continued building what they wanted to instead.   Overall I do think it was successful and

children learned new things, though not exactly what I had. For example, children did learn and

were interested in the different texture shapes and sizes and were explaining that.   Learning

different shapes, texture and sizes are important because they are important for the latter skill of

classification.

References.

Bailey, H. D. (2014, Nov 14) What's the Point of Teaching Math in Preschool? *Brookings*

Institution. Retrieved from:https://www.brookings.edu/research/whats-the-point-of-

teaching-math-in-preschool

Clements, D. H., & Sarama J (2016). "Math, science, and technology in the early grades."

The Future of Children 26(2):75-94 DOI: 10.1353/foc.2016.0013

Duncan, G. J., Dowsett, C. J., Claessens, A., Magnuson, K., Huston, A. C., Klebanov, P., Pagani,

L. S., Feinstein, L., Engel, M., Brooks-Gunn, J., Sexton, H., Duckworth, K., & Japel, C.

(2007). School readiness and later achievement. *Developmental Psychology*, *43*(6),

1428–1446. https://doi-org.library2.csumb.edu:2248/10.1037/0012-1649.43.6.1428.supp

(Supplemental) Achievement. Developmental Psychology, 43(6), 1428–1446.

https://doi.org/10.1037/0012-1649.43.6.1428

Fyfe, E. R., Rittle-Johnson, B., & Farran, D. C. (2019). Predicting success on high-stakes

math tests from preschool math measures among children from low-income homes.

Journal of Educational Psychology, 111(3), 402–413.

Gray, S. A., & Reeve, R. A. (2014). Preschoolers' dot enumeration abilities are markers

of their arithmetic competence. *PLoS ONE*, *9*(4), 1–11. https://doi-

org.library2.csumb.edu:2248/10.1371/journal.pone.0094428

Klemens, D. (2013). Math in the early years.   *The progress of education reform. 15(5).*

Retrieved from: http://www.ecs.org/clearinghouse/01/09/46/10946.pdf

Klibanoff, R. S., Levine, S. C., Huttenlocher, J., Vasilyeva, M., & Hedges, L. V. (2006).

Preschool children's mathematical knowledge: The effect of teacher "math talk."

Developmental Psychology, *42*(1), 59–69. https://doi-

org.library2.csumb.edu:2248/10.1037/0012-1649.42.1.59

Pigate, J (1964). " Part 1/Cognitive development in children: Pigate/ Development and learning

Journal of research in science teaching, 2, 176-186

Reid, M., Chamberlain S. (1990) *The Button Box.* New York, New York: Puffin Books.

Table A

Learning outcome 1

Identify 2 similarities between blocks

1	2	3	4
Square	Triangles	Different triangles	Soft/Hard Squares.

Table 2

Learning outcome 2

Identify 2 ways to sort by different traits

	1	2	3	4
Round 1 Sort one way	Sorts Triangle from square	Square From Triangle	Sorts Triangle from Square	Sorts triangles from squares
Round 2 Sort the blocks a different way	Building towers	castle/making patterns	Building tower	Building

Learning outcome 3

kid	1	2	3	4
1	Square	Triangle	N/A	N/A
2	Not Answered	NO, They are not different	Not Answered	Not Answered

Appendix A

Book Question

What is similar about these buttons

What is similar shape are they

What do the buttons have on them?

Can you think of anything else that matches?

Appendix B

How are these similar?

What did you do?

How are they similar?

How are they alike?

Appendix C powerpoint

Piaget Theory Of Cognitive Development

- **Preoperational Stage**

Piaget's Stages of Cognitive Development

Stage	Age range	What happens at this stage?
Sensorimotor	0-2 years old	Coordination of senses with motor responses, sensory curiosity about the world. Language used for demands and cataloguing. Object permanence is developed.
Preoperational	2-7 years old	Symbolic thinking, use of proper syntax and grammar to express concepts. Imagination and intuition are strong, but complex abstract thoughts are still difficult. Conservation is developed.
Concrete Operational	7-11 years old	Concepts attached to concrete situations. Time, space, and quantity are understood and can be applied, but not as independent concepts.
Formal Operational	11 years old and older	Theoretical, hypothetical, and counterfactual thinking. Abstract logic and reasoning. Strategy and planning become possible. Concepts learned in one context can be applied to another.

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Learning outcomes

At the end of the project children will understand how

1. Identify 2 similar characteristic between blocks,

2. Identify 2 ways to sort by different traits

3. Explain how they sorted by different traits

LO 1

MET

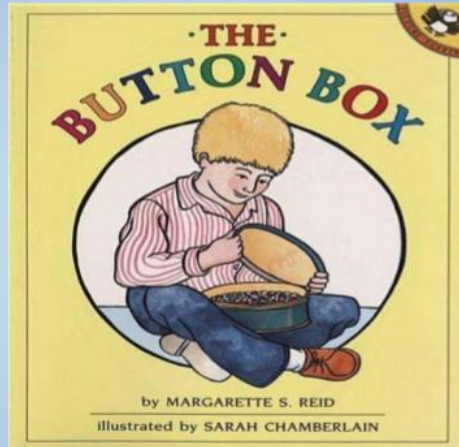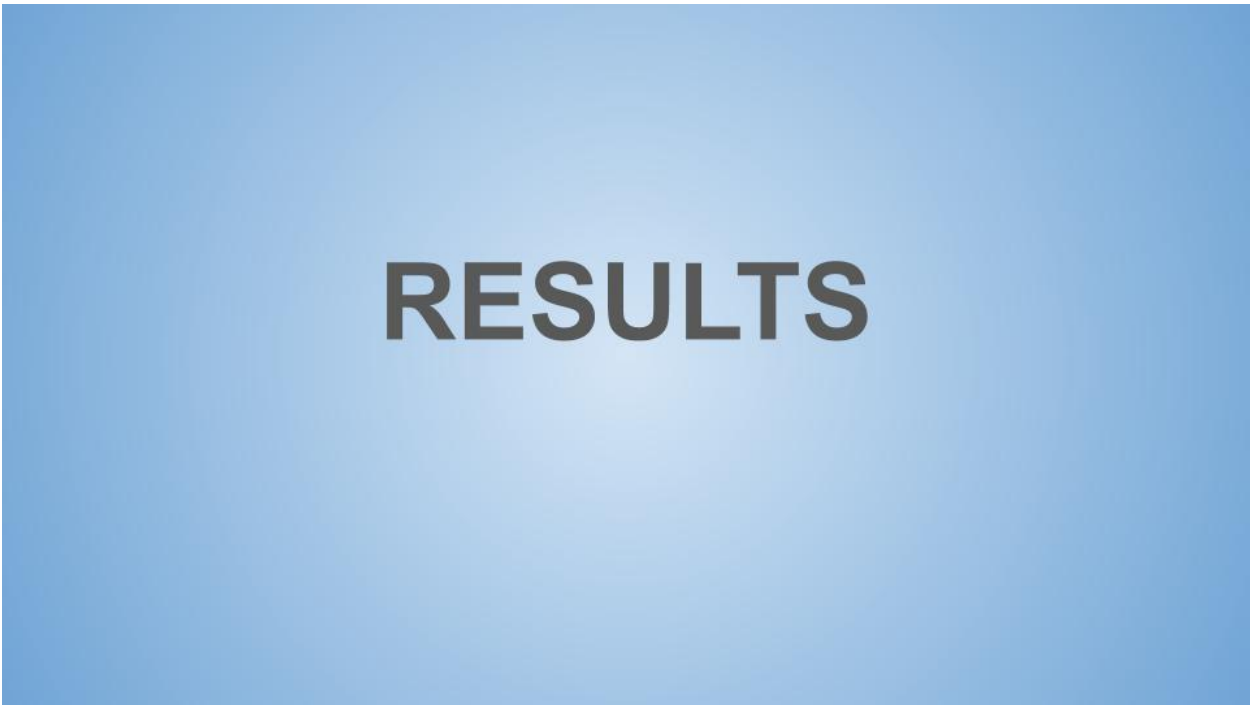|	Child 1	Child 2	Child 3	Child 4
Identify 1 object	Square	triangle	Square	Triangle
Identify different object	Triangle	square	Triangle	Soft/Hard

LO 2

PARTIAL MET

	Child 1	Child 2	Child 3	Child 4
Round 1	Triangle from square	Square from triangle	Sorts triangle from square	Triangles from stairs
Round 2	Tower	castle	Soft tower	building

LO 3

Not Met.

	Child 1	Child 2	Child 3	Child 4
Round 1 Answer	soft/hard	Not answered	Not answered	Not answered
Round 2 Answer	Not answered	NO	Not answered	Not answered