Learning Plan

Name: Lisa Meyer	**Age of Children**: 6 – 10 years	**Date**: November 18, 2021
Title: Wood Stack Rectangular Rays		

Learning Standards and Outcomes

Learning Standard:

Math Common Core State Standards

CCSS 2.OA.A.1 Use addition and subtraction within 100 to solve one and two step word problems. Involving situations of adding to, taking from, putting together, taking apart, and comparing with unknown in all positions by using drawings and equations with a symbol for the unknown number to represent the problem.

CCSS 2.OA.B.4 Use addition to find the total number of objects arranged in rectangular arrays with up to 5 rows and up to 5 columns; write an equation to express the total as a sum of equal addends.

New Generation Science Standards

2-PS1-3 Make observations to construct an evidence-based account of how an object made of a small set of pieces can be disassembled and made into a new object. [Clarification Statement: Examples of pieces could include blocks, building bricks, or other assorted small objects.]

National Standards Visual Arts – Creating

VA:Cr1.2.2a Make art or design with various materials and tools to explore personal interests, questions, and curiosity.

Child Outcome:

The Student will be able to …

1. **Define a rectangular ray.**
2. **Make several different rectangular rays with the same number of pieces.**
3. **Make observations of the number of rows.**
4. **Make observations of the number of columns.**
5. **Make observation of the different shaped rectangles when the number of pieces in the rows or columns are altered even though the total number of pieces stays the same.**
6. **Make a drawing to visually represent their mathematical thinking displayed in their rectangular ray.**
7. **Write an equation that has two equal sides separated by an equal sign using the equal addends found in the rows of their rectangular ray.**
8. **Use addition to show the total number of pieces in their rectangular ray.**
9. **Make an artistic design using the formation of a rectangular ray.**

Learning Experience

Describe the Learning Activity/Opportunity

Children will learn about rectangular rays. Children will be given pictures of stacked fire wood in a wood shed. The rows and columns of a rectangular ray will be visually displayed in a real life environment. The relationship between the created 3d rectangular ray and a 2d drawing of a rectangular ray will be explored. Students will observe how to calculate how many pieces are in each row and how many columns make up the rectangular ray. Students will observe how to write an equation using equivalent addends represented by the number of objects in each row. Students will then explore how to make their own rectangular rays by building several from varying amounts of blocks or other objects. Students will create their own drawings and equations to represent their rectangular rays.

Younger children should be encouraged to start with a smaller number of small pieces to fit their addition skills. Older children may enjoy the challenge of working with a larger number of pieces. Be sure to control the overall total of pieces until several different rectangular rays are formed from the same total. Then guide children in selecting a new total to work with to produce new rays to draw and write equations for. Guide children in making scientific observations by looking at how changing the number of pieces in the rows and number of columns changes the overall shape of the rectangular ray.

Resources Needed:

Paper, any writing tool, any small objects that can be stacked like blocks or building bricks. Other household items that stack are pillows, books, crackers, coins, or sections of a Hershey's candy bar. Anything you have around the house will work! Use your imagination and see what most interests your child.

Procedures:

1. ***ENGAGE***

Rectangular Rays-

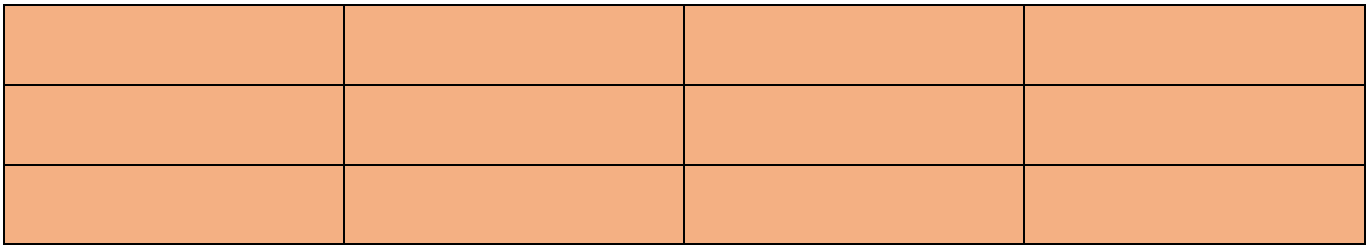
A rectangular arrangement of objects into rows and columns

Rectangular Rays in Everyday Life:

"I am in the wood shed with my son Moses. One of our family chores is to stack wood away for the winter. I notice that this stack of wood, we are working on, looks like something in math. It looks like a rectangular ray. Notice how there is wood in a shape. If I would take a pen and go along the shape of this little stack of wood, what shape is it? You are right! It's a rectangle! In our rectangular ray, there is one, two, three rows. How

many pieces of wood are in each row? Let's count it. One two three four. I wonder if I can make a picture of this?"

"Here is my rectangular ray.



I have three rows and four columns.

Rows are the arrangement of objects from left to right, side-by-side, the horizontal lines. **Columns** are the arrangement of objects one above the other, objects stacked up-down, the vertical lines.

If I were to write an equation, using equal addends, I would know how many blocks of wood I have. I could take the 4 pieces of wood in each row and add them together.

So, it would look like this. 4 + 4 + 4 = 12
(The number 4 is my **equal addends**.)

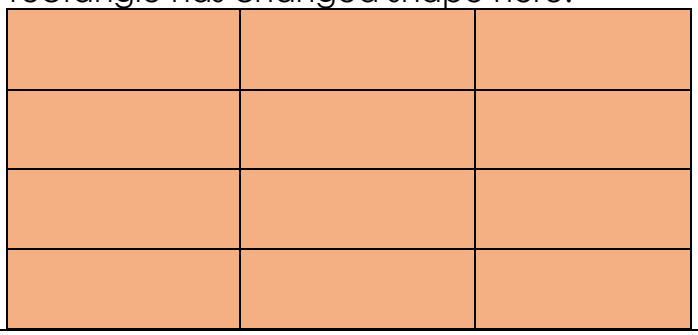
Equal addends – addends of an equation that are equal in value.

If I wanted to do some mental math, I could say 4 plus 4 equals 8, plus 4 more equals 12. Yep, it makes sense!"

2. *EXPLORE*

"Look what Moses did! He rearranged the wood blocks to make a new rectangular ray. Let's see what we have this time. We have one, two, three, four rows. In each row, I have one, two, three blocks of wood. I bet I could draw a picture of that!

Notice that my rectangle has changed shape here.

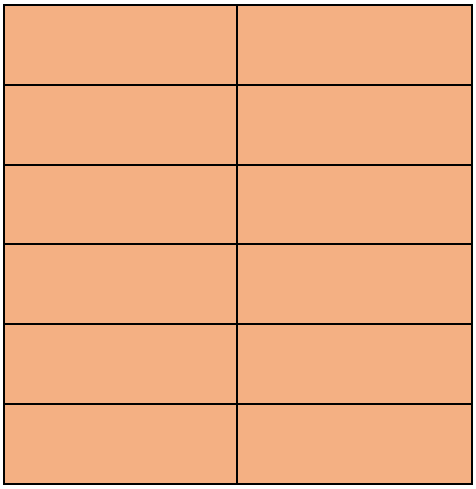


I now have four rows. In each row, I have how many? Three
To write an equation for this rectangular ray, I use equal addends.

I can write. **3 + 3 + 3 + 3= 12** It still equals 12!"

(The number 3 is my **equal addends**.)

"It looks like Moses has done something over here in the woodshed for us. Wow! That is a cool build. I like it! It is different. Okay, this is going to be even taller. This ray only has two columns, but six rows. That is a tall one!"



"How many do I have in each row? Two
I can write an equation for this rectangular ray.

2 + 2 + 2 + 2 + 2 + 2 = 12

(The number 2 is my **equal addends.**)

If I wanted to check my work, I could count by 2's: 2, 4, 6, 8, 10, 12. Yep!
I got to twelve in three different ways! Have fun making rectangular rays."

3. *MAKE SENSE*

Guided Discussion During the Building of Rectangular Rays.

Tell me what a **rectangular ray** is?

"Right! A rectangular arrangement of objects into rows and columns**."**

1. Given these blocks (or whatever you are using) can you make a rectangular ray?
2. How many **rows** do you have?
3. How many **columns** do you have?
4. Can you make another rectangular ray shape with the same number of pieces?
5. What happens when you change the number of pieces in the rows and columns?
6. Make a drawing to visually represent your mathematical thinking when you made your rectangular ray.
7. Write an equation that has two equal sides separated by an equal sign using **equal addends** found in the rows of your rectangular ray.
8. Use addition to show the **sum** of pieces in your rectangular ray.
   Sum- the total number of objects added.

If you could make a rectangular ray out of _____ pieces, what would it look like ?

1. **Child builds a rectangular ray and shows it to an adult.**
   "Can you show me your rectangular ray?"
2. **Child tells their observations to an adult or fellow student.**
   "Tell me about your rows and columns."
   "How many rows did you make?"
   "How many columns did you make?"
3. **Child draws a picture to represent the rows and columns of their rectangular ray.**
   "How would you draw a picture to represent the rectangular shape of your rectangular ray."
   "How could you draw lines in the middle of your shape to show the rows and columns of your design."
4. **Child writes an equation to represent their rectangular ray using equivalent addends.**
   "How would you write an equation to represent your rectangular ray?"
5. **Can you take that same number of pieces and make a different rectangular ray?**
6. **Repeat the process with several different rectangular rays first built by the child then drawn and represented by an equation.**

"Can you draw a picture to represent each of your rectangular rays?"
"Can you write an equation that represents your rectangular rays?"

Remember: Write an **equation** to show your mathematical thinking and displays your rectangular ray. An equation is a mathematical sentence that has two equal sides separated by an equal sign.

1. CLOSE

"Wow, look at all the rectangular rays we have here. You must be a very good builder! Tell me all about your rectangular rays."

Ask children to share their own documentations of their rectangular rays.

I will check that the visual representation in their **pictures** match their rectangular ray. For example, the number of rows and columns matches what they have built with blocks. I will also check their **equation**. Looking to see if the row quantities match the equivalent addends for their addition problem. Then looking to see if the number of times the addends were added together matches the number of rows in the ray. The correct answer to the children's equations is also important so that both sides of the equation are equal to each other and separated by an equal sign. The correct answer or **sum** will show the total number of objects in the rectangular ray.

Conclusion Questions to ask the Child:

"Does your picture of your rectangular ray display the correct number or rows and columns?"
"Does your equation accurately represent your rectangular ray?"
"Does your equivalent addend match the number of objects in your rows?"
"Does the number of times you added your addends match the number of rows?"
"Does the sum of your equation accurately represent the total number of objects in your rectangular ray?"

2. ***FOLLOW UP***

"Congratulations on building and drawing your own rectangular rays!"

<u>Continuation of Rectangular Rays</u>:

Add to the rectangular ray building by repeating the same lesson, but with the emphasis on multiples. The children pick a number to have in a row, then add rows sequentially. This process will lead to the discovery of multiples. For example if the student chooses to place three objects in a row and adds a row at a time. Students will discover the multiples of three are 3, 6, 9, 12, 15, 18, 21, 24… the children will then draw pictures and equations to represent their discoveries. The important and effective strategy of drawing a picture and writing equations will be continued throughout the school year.

List a minimum of 3 new vocabulary words that children will develop as part of this learning plan:

1. **Rectangular Ray**: a rectangular arrangement of objects into rows and columns
2. **Rows** are the arrangement of objects from left to right, side-by-side, the horizontal lines.
3. **Columns** are the arrangement of objects one above the other, objects stacked up-down, the vertical lines.
4. **Equal addends** – addends of an equation that are equal in value.
5. **Sum**- the total number of objects added.
6. **Pattern**- a repeated arrangement of numbers, shapes, or colors. (Patterns are infinite in numbers)

3 open-ended questions:

1. **How would you draw a picture to represent the rectangular shape of your rectangular ray?**

2. **How would you write an equation using equivalent addends to represent the number of objects in each row?**

3. **Can you take that same number of pieces and make a different rectangular ray?**

4. **Where do you see rays in your everyday life?**

5. **How might the mathematical concept of a rectangular ray be helpful to solve math problems?**

Why this activity is developmentally appropriate for this group of children.

Age Appropriate-
Hands on discoveries of mathematics concepts allows children to experience the evidence themselves. Manipulating the number of rows and the number of columns allows the child to guide their own learning experience. The building and rebuilding of rectangular rays, allows the child to become familiar with the skills necessary to understand multiplication. This engaging lesson will have even your most reluctant students excited about their next build. Give your student the incentive of documenting their rectangular rays by making pictures and writing equations that match their master piece. This lesson incorporates fundamental skills in both math and science that meet common core learning standards.

Individually appropriate-
Children choose the objects that they want to manipulate and the number of objects that they want to work with. Children discover the characteristics of a rectangular ray's rows and columns through guided play and exploration. Younger children may be guided with a smaller number of small pieces to fit their addition skills. Older children may enjoy the challenge of working with a larger number of pieces. Children who desire a challenge can give themselves more pieces.

Questions to Ask Children:
"Do you want an easier math problem? Give yourself a smaller number of pieces to make your rectangular rays."
"Do you want a challenge? Give yourself a larger number of pieces to make your rectangular rays?"

Culturally Appropriate-
Teaching children to observe the characteristic of rectangular rays is relevant in the building of mathematical concepts in every culture. Mathematical skills are foundational to the civilization and establishment of modern technologies needed in many cultures.

Families who want their children to be competitive in the working world will encourage their children to learn the operations of mathematics.

"What are the mathematic skills you are learning that will help you to be successful at school and in the work place?"

1. ***Promoting Analysis and Reasoning:***

Mathematical Connection Questions:
Students Make Observations:
"Why do some numbers of objects make rectangular rays and some do not?"
"Why do even numbers of objects always make rectangular rays?"
"Why do some odd numbers of objects don't make rectangular rays?"

Students Make Predictions:
"Will nine objects make a rectangular ray?"
"How many different rays can you make with nine objects?"
"Will fifteen objects make a rectangular ray?"
"How many different rays can you make with fifteen objects?"

2. ***Promoting Opportunities for Creating:***

Brainstorming-

1. Discussion of the number of different kinds of rays that can be made with 20 objects.

"How many different kinds of rays can you make with 24 objects?"

Planning-

1. **Children will plan their strategies for discovering all the rectangular rays that they can make with 24 objects**.

"What objects will you use to make your rectangular ray?"
"Are your pictures a good representation of your rays?"
"Do your pictures help you remember the rays you have already built?"
"Do your pictures help you think of new rays to build?"

2. **Children will plan their equation that is a math sentence that has two equal sides separated by an equal sign**.

"Does your equation have two equal sides separated by an equal sign?"
"Does you equation have the correct answer making both side equal to each other?"
"Do you have equivalent addends that describes how many objects are in each row?"

Authentic Production-

1. Children will produce authentic representations of their rectangular rays.

"Does your picture of your rectangular ray display realistic characteristics of your blocks?"
"Does your picture of your rectangular ray represent the specific quantities of your rows?"

"Does your picture of your rectangular ray represent the specific quantities of your columns?"
"Does your equation accurately represent the total quantities of objects in your rectangular ray?"

3. ***Promoting Opportunities for Integration:***

Visual Arts Connections Discussion Questions:

Pattern- a repeated arrangement of numbers, shapes, or colors.

"What patterns are found in rectangular rays?"
"What designs are found in rectangular rays?"
"What colors could be added to a rectangular ray to enhance a pattern?"
"What colors could be added to a rectangular ray to create a unique design?"
"Would you like to design a work of art by drawing objects in a rectangular ray?"
"How would you add color to your design to enhance the patterns?"

4. ***Promoting Opportunities for Connections to the Real World:***

Real World Rectangular Rays:
"Do **farmers** use rectangular rays to plan how to plant crops?"
"Do farmers plan how many rows to plant and how many plants in each row?"

"Do **game makers** use rectangular rays to plan a game board?"
"How do game makers plan how many rows to put on a checkers or chess board?"
"How do game makers plan how many game pieces will set in each row, thus the number of columns needed to play the game?" "Why?"

"Do **Hersey chocolate bar makers** use rectangular rays to plan the smaller pieces in their bars?"
"How do candy makers plan how many rows to put on their candy bars?"
"How do candy makers plan how many sections will be in each row?"
"How do they consider the size of the sections compared to the whole bar?"
"How do they consider the size of the sections compared to your mouth?" "Why?"

I certify that the lesson I am submitting does not utilize a worksheet or rote learning experience. My lesson is focusing on promoting concept development through high quality interactions and everyday materials easily obtained in a family's home or surrounding outdoor environment. The outcome of my lesson is not a "cookie cutter" product.

__x__ Yes

____ ***No***