

Research

Multiplication

An article by *Speiser, et. al.*, 2012, explains why paper-and-pencil multiplication is difficult for so many individuals. They explain that as humans we have limited working memory and attentive focus capacity. By its very nature, working memory is open to distraction and hence is easily disrupted. The more you need to hold concurrently in working memory, the more difficult your task becomes. A suggestion given in the article is to use multiple strategies that engage various areas of the brain (i.e. kinesthetic activities activate the motor areas of the brain).

Array

An array is an arrangement of rows or columns that is used as a tool to display multiplication & division. This tool could be used for learning or teaching these skills. Understanding structures is a “big idea” in learning mathematics. A big idea for teaching multiplication is through the commutative property, which allows children to see and explore the properties of multiplication “in a two-dimensional array drawn on graph paper”. Using arrays are beneficial to the understanding of multiplication as students “create spatial structures for sets of objects through the mental actions they perform on objects” (Fosnot & Dolk, 2001).

Hands-On Activities to Teach Multiplication

Multiplication is a difficult area of mathematics for children to understand. It often causes negative attitudes towards math and affects one’s ability to solve math problems. Engaging math has been used to reach students with various learning needs, ensure understanding and success in mathematics. Our aim is to demonstrate hands-on teaching strategies that can be used to teach students multiplication in a meaningful way.

The National Assessment of Educational Progress (2013) conducted a study on 14-year-old students in general education. The results showed that only 50% of the students were mastering multiplication skills. With half of the students struggling in multiplication, an important question to ask is how do we recognize these struggling students and how do we support them?

CONTEXT:

Our activities use a variety of arrays to teach multiplication. Using arrays promote students’ use of spatial reasoning as they visually apply multiplication to spatial structures. An array allows for students to visually see and manipulate the area that multiplication equations create. By examining a set area on an array, students can also visually see the different parts that make up a whole.

ACTIVITIES:

1) CUT AND PASTE MULTIPLICATION



Students play this game individually or in pairs. Students are given two dice, graph paper, and a large piece of coloured paper on which to ‘paste’ their answers. First, roll the dice to get a multiplication question (i.e., 6 X 6) and use this equation to draw

an array. An option to make this more challenging is to give students a deck of cards instead of dice to work with larger numbers. Students cut out their original array. They can then explore what makes up their multiplication question by cutting their array into smaller arrays (i.e., 3 X 6 + 3 X 6 = 6 X 6). Students ‘paste’ their cut arrays onto a piece of paper to show that it is equal to the original equation. There are different ways for students to cut their original array - encourage students to find as many ways to show the original array as possible.

Material Options

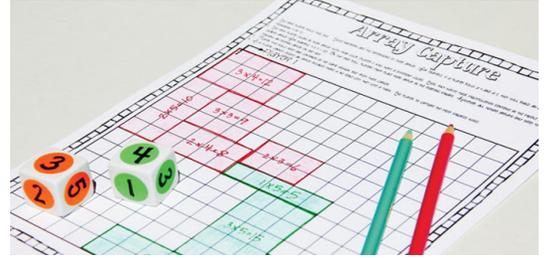
- Multiple Sized Grid Paper
- Dice
- Mathlink Cubes
- Lego
- Construction Paper
- Pencils
- Markers
- Dry Erase Markers
- Base Ten Blocks
- Muffin Tray
- Dominoes
- Stickers
- Scissors
- Glue
- Bingo Dabbers
- Deck of cards

How to Support Our Students

Struggling students may demonstrate lack of engagement, negative attitudes towards multiplication, a sense of discouragement when engaged in multiplication, and avoidance of math all together. Struggles in math and multiplication can also lead to math anxiety. Math anxiety is a common, yet a very real concern and should not be ignored. When students develop math anxiety, it can transfer into their adult life, as Beilock and Maloney (2015) explain, “many people also experience anxiety even when engaging in mundane everyday math tasks like calculating a tip at a restaurant or deciding whether or not they received the proper change at the grocery store [...] in fact, for some people, their levels of math anxiety are so high that they become nervous even simply reading aloud mathematical equations.”

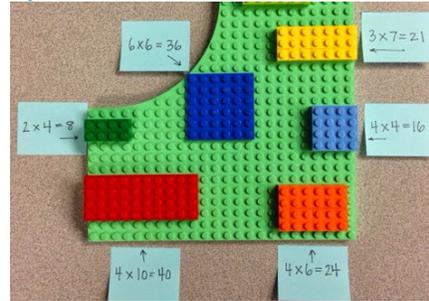
2) BATTLE OF ARRAYS

Students play in pairs. They are given a “Battle of Arrays” Game Board and a set of dice. Player 1 rolls the dice and uses a marker to colour in/draw the array of the given two numbers,



then writes the answer of the multiplication problem. Player 2 then rolls the dice and repeats the above steps using a different coloured marker. If a player can't find an array, they miss their turn. The winner is determined by the player who has coloured in the most squares when time is up or the grid is complete.

3) LEGO CONNECTION



This activity allows students to have a visual model and has multiple variations to meet a range of learners. Students can focus on using smaller pieces and focus on arrays up to 6 x 6. Place the arrays on the Lego sheet, using Lego cubes and label the multiplication equation it

replicates. Students can also make large arrays with multiple Lego pieces and show their ability to solve multi-digit multiplication problems by grouping into smaller arrays. It is important to let students play, as well as encouraging the labelling and explaining of their creations in this

MODIFICATIONS

A. Muffin Tray

Using a muffin tray (3 by 4) serves as a more basic way to visualize arrays. Students can use various objects to fill in the muffin tray to create an array. Students may work 1 on 1 with a teacher. For example, a teacher might ask “What is 2 x 2?”, and a student can use objects of choice to fill in the muffin tray in order to demonstrate that multiplication problem.

B. Using Stickers

Students can roll a set of dice and use stickers to fill in an array of the given 2 numbers on a sheet of grid paper. Providing multiple types of stickers adds choice and excitement for students.

C. Mathlink Cubes/ Bingo Dabbers

Students can roll a set of dice and use Mathlink cubes to physically hold and feel the amount of area being covered or bingo dabbers to fill in an array of the given 2 numbers on a sheet of large grid paper. Students can work individually or in pairs. If in pairs, two different coloured bingo dabbers will be required.