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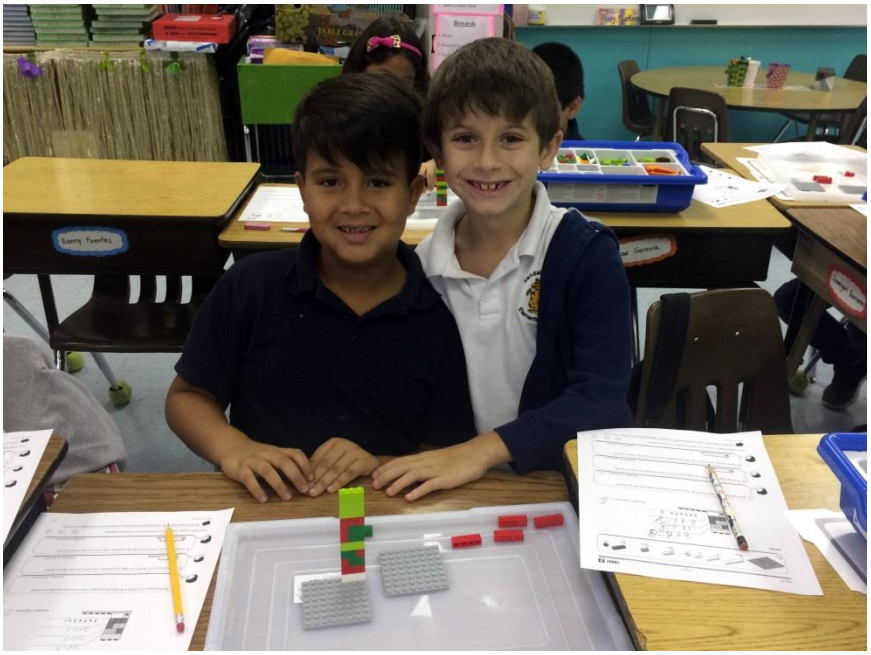
LEGO: MoretoMath Than Meets the Eye

LEGO: MoreToMath than Meets the Eye

(Originally an Innovator Grant sponsored by the P.L. Dodge Foundation)



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Goals and Objectives

The goals and objectives of an educator are to plan and present a lesson which will be meaningful, understood, retained, and eventually applied by the student successfully. Yet in reality these goals and objectives seem to miss the mark when it comes to math. Wouldn't it be awesome if all educational lessons came in a LEGO box? Let's be honest, kids love to play and what better way to grasp our new Common Core State Standards (CCSS) than to visualize and manipulate objects in order to understand it. All the lessons within each activity in the new LEGO MoreToMath Curriculum Pack cover the CCSS of numbers and operation in base ten, operations and algebraic thinking, measurement and data, and geometry and spatial skills.

Mathematics Florida Standards

Domain: MAFS.2.G Geometry

Domain: MAFS.2.MD Measurement and Data

Domain: MAFS.2.NBT Number and Operations in Base Ten

Domain: MAFS.2.OA Operations and Algebraic Thinking

Introduction

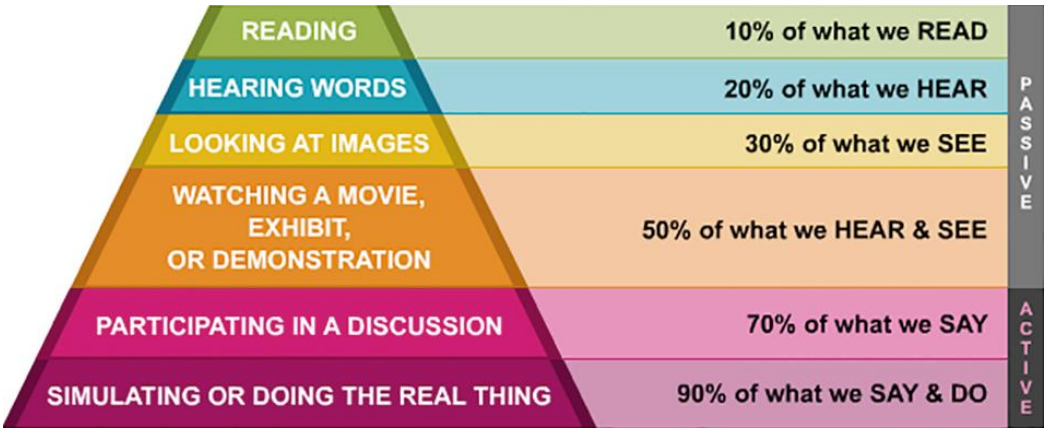
The LEGO MoreToMath Curriculum pack is an innovative hands-on educational tool designed for 1st and 2nd graders targeting mathematical problem solving. This classroom resource uses the LEGO brick as the tool that makes theoretical abstract mathematical concepts tangible for students. This is precisely what students need in order to succeed given our CCSS in Math. The MoreToMath set is designed to be used within our current math curriculum, providing teachers with training videos, an interactive whiteboard software and teacher/student worksheets with built-in assessment that teaches and reinforces the eight practices of mathematical problem solving as defined by the latest Common Core Math standards. The aim of the 48 lessons (24 for 1st grade and 24 for 2nd grade students) in the MoreToMath curriculum pack is to provide concrete but challenging problem solving activities for students using the LEGO brick as a hands-on manipulative through which mathematical investigation occurs.

According to Hood (2005), the LEGO brick is the perfect manipulative for the tactile/kinesthetic needs of early elementary students since the visual and hands-on approach to problem solving presented in the activities helps students creatively see abstract concepts more concrete. This hands-on approach is an excellent teaching strategy to explain and then have students demonstrate mastery of the desired mathematical activity or lesson.

The reality is that students will probably forget the lessons previously taught within a matter of days (sometimes even hours). According to Cooperstein & Kocevar-Weidinger (2004) students forget 80% of what they have just learned within the first 24 hours unless the lesson is applied to concrete activities. How many times have teachers asked a question about a topic recently discussed in class and have had absolutely no students respond correctly? Does this scenario sound familiar? Don't be discouraged, it has happened to everyone at one point or another. But what if there was a way to encode in our students minds permanent lifelong learning. Wouldn't that be amazing?

According to Dale (1969) learners retain more information by doing rather than hearing, reading, or observing. Edgar Dale (1969) designed a model that incorporates several theories related to the learning processes of an individual in what is now known as the "Cone of Experience." Dale (1969) theorized that individuals generally remember 10% of what they read, 20% of what they hear, 30% of what they see, 50% of what they see and hear, 70% of what they say, and 90% of what they say and do. Therefore, when students are actively involved in the learning process by doing rather than just listening there is a much better possibility of learner retention. This is exactly what students are able to do with the LEGO MoreToMath Curriculum set.

E. Dale's Cone of Experience



Adapted from Edgar Dale, Audiovisual Methods in Teaching, 1969, NY: Dryden Press.

According to Willis (2006) technological advances are enabling scientist to view the working brain as it learns, and educators can use "evidence-based neuroimaging and brain-mapping studies to determine the most effective ways to teach." So the question educator's should be asking themselves is, "How can I teach a lesson that attracts student attention and engages them to think critically yet becomes retained in a student's brain for later retrieval?" Well first according to Willis (2006) educators have to capture a student's attention by awakening those hormones that cause pleasure such as humor and visuals. Successful educators can use a wide variety of strategies to captivate student interest. Willis (2006) states that, "Once student's attention focuses, they are empowered to become engaged in their learning process." But this is only the beginning, teachers must offer varied ways of communicating their lesson in order for students to successfully store and retain the lesson material. This is why I begin my lessons with a GoNoodle brain break.

Using the latest Mathematics Common Core standards, the MoreToMath Curriculum Pack helps 1st and 2nd grade teachers in presenting dynamic mathematical lesson which students actually look forward to participate in. The LEGO MoreToMath educational set was used within my math teaching block as a supplemental tool aimed at reinforcing and teaching the mathematical problem solving practices given the latest national standards. According to Zimmerman (2013), "composing and decomposing numbers is a key component of building the number sense needed for arithmetic operations" for younger math students. Zimmerman (2013) goes on to describe the importance of using manipulatives such as LEGO's to teach basic mathematical concepts especially part-part-total math and base ten concepts used in our CCSS. Using the LEGO MoreToMath curriculum pack provided my ESOL students the extra edge they need to reduce the achievement gap and help them achieve academic success.

Having used the LEGO MoreToMath set reinforced the math skills introduced in class. Students were able complete the hands-on activities

which improved their critical thinking and problem solving skills while working collaboratively. The LEGO MoretoMath curriculum pack includes everything a teacher needs to integrate each lesson with student worksheets, and interactive software making it very easy to use.

The Standards for Mathematical Practice describe varieties of expertise that mathematics educators at all levels should seek to develop in their students. These practices rest on important "processes and proficiencies" with long term importance in mathematics education. The LEGO Education MoreToMath 1-2 activities promotes creative engaging mathematics lessons focused on problem solving, critical thinking and logical reasoning, exactly what the new state Common Core Math standards try to achieve. For example, five plus five might always equal ten, but not all math problems have only one solution and often there are multiple ways to find the right answer. Similarly, when students are practicing mathematics, they use a variety of learning styles to help them solve the task at hand. The curriculum pack includes 24 lessons for 1st grade students and 24 lessons for 2nd grade students. Each lesson is designed for a 45 minute class period which will be enough time within the 60 minute daily math block. For each of the 24 grade specific lessons there is one student worksheet.

One of the activity lessons I was able to teach with the LEGO MoreToMath was called Running. The activity asks students to bundle 100 into groups of 10, as well as to count within 1000. The mathematical practices utilized include attention to precision and making sense of problems. I sat students in pairs and each team worked on the same activity. Each of the 16 activity sets (8 for 1st grade and 8 for 2nd graders) consists of material for three lessons including an integrated assessment. There is a progression in the level of difficulty from Lesson 1 to Lesson 3 within each activity set.

The MoreToMath set also provides students who complete their task quickly with the Purple Brick Challenge. This challenge is located on every student worksheet in the Curriculum Pack, and takes students' problem-solving abilities to the next level, extending the learning from

the core lesson on their worksheet. Each purple brick icon marks an additional task for the student to consider, should they finish the core lesson before others in the class.

Running Lesson Plans using LEGO®

Introduction:

I began by relating the lesson to prior knowledge. Since my 2nd grade student take physical education in school I had them think of a day where they had to run laps. There were times when they had to run a certain distance instead of running an entire lap. Then, using that prior knowledge experience I displayed an image to help them visualize running a lap on a track.

Running Lesson Math Learning Objectives for 2nd Grade:

MAFS.2.NBT.1.1: Understand that the three digits of a three-digit number represent amounts of hundreds, tens, and ones.

MAFS.2.NBT.1.2: Count within 1000

MAFS.2.NBT.1.3: Read and write numbers to 1000 using base-ten numerals, number names, and expanded form.

MAFS.2.NBT.2.5: Add and subtract within 100 using strategies based on place value.

MAFS.2.NBT.2.7: Add and subtract within 1000 using concrete models

MAFS.2.MD.1: Measure and estimate lengths in standard units.

MAFS.2.MD.4: Represent and interpret data

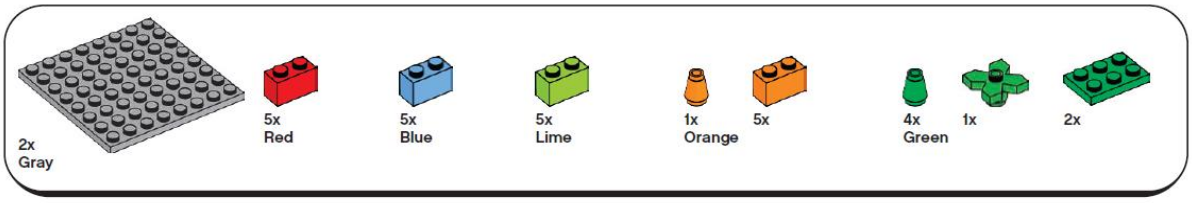
LEGO Vocabulary Tip: A round peg on top of a LEGO brick is called a "stud."

Materials needed:
LEGO® Education MoreToMath Curriculum set

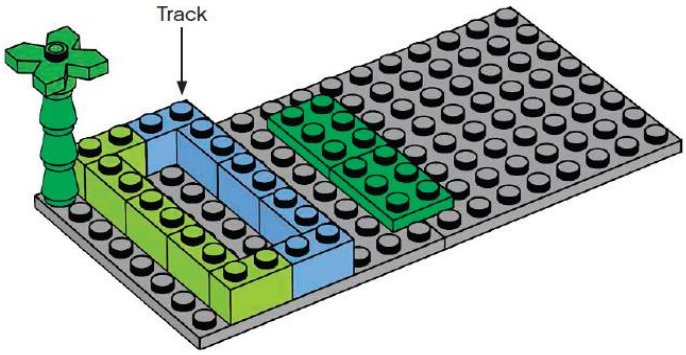
Activity:

1. Have students find the bricks needed for the activity.
2. Pass out the accompanying activity worksheet and allow the students to build the model shown on the worksheet.
3. Read each task out loud and have students underline or highlight the words that create meaning in the worksheet.
4. In this Running Lesson #1, students need to figure out how far Max runs by counting the studs.
5. Students should be familiar with the meaning of **halfway** in order to answer the questions designed for this worksheet.
6. Have students work in pairs to answer question #1 and write their answers on their individual activity worksheet.
7. The color coding of the bricks can help students count the studs. There are 10 studs in one color. Note that the two green 2x3 plates are used for connecting the two gray plates only and do not have any other purpose in the running track.
8. The answer to question #1 is 10 studs.
9. Then have students begin trying to figure workout questions #2, #3, and #4 in sequence.
10. Have students take the model apart before advancing to the next numbered questions.
11. If students complete all 4 questions they can try to do the Purple Brick Challenge.

Name: Class: **RUNNING 1**



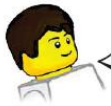
Running Track



Mia Max

1 Build the running track. Max runs halfway around it. How far does he run?

____ studs

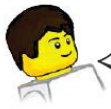


2 Mia runs a distance of sixty studs in total around the same track. How long is one lap, and how many laps does she need to run?

1 lap = ____ studs ____ laps

3 Max runs a distance of eighty studs in two laps. Build this track. How long is one lap?

____ studs



4 Build a running track. It should be longer than twenty studs but shorter than forty studs. How long is one lap?

____ studs

I can build and count up to 100.

Build a track that is thirty studs long with a pattern in it.

These are additional worksheets that can be used to help students visualize varied concepts such as: part-part-total, multiplication and division, fractions, and analyzing data (such as mean, mode, median, and range).

Lego Part-Part-Total Diagrams

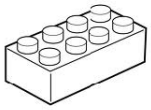
Part	Part
Total	

Part	Part
Total	

A. Zimmerman, 2012

Exploring Equivalent Fractions with LEGOS

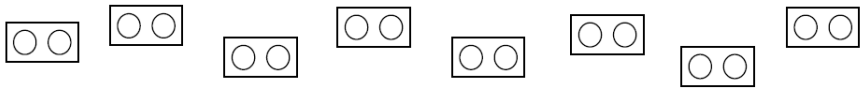
Lego Terminology Tips: A round peg on top of a Lego is called a "stud." We can name Lego bricks by their stud dimensions.



Warm up:

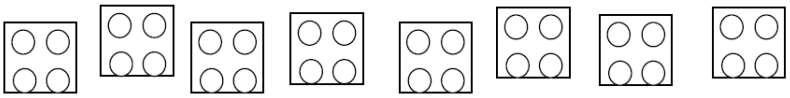
This piece has _____ studs. It is a ___ by ___ brick.

Take a bag of eight **1 by 2 bricks**. Color the bricks below to match the bag.



Brick Colors	Fraction of Total Bricks (Out of 8)	Fraction of Total Studs (Out of 16)

Take a bag of eight **2 by 2 bricks**. Color the bricks below to match the bag.

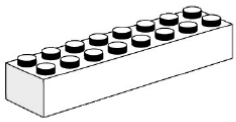


Brick Colors	Fraction of Total Bricks (Out of 8)	Fraction of Total Studs (Out of 32)

Exploring Mean, Median, Mode, and Range with LEGOS

Mean, median, and mode are three different ways to describe the average of a set of numeric data. They are statistical ways to describe the "centrality" of the data set.

Lego Terminology Tip: A round peg on top of a Lego is called a "stud." We can name Lego bricks by their stud dimensions.



Warm up:

This piece has _____ studs. It is a ___ by ___ brick.

☞ Take a bag of Lego bricks.
Sort the bricks by the number of studs and fill in the table below.

# of Studs	1	2	3	4	6	8	10	12	14	16
# of Pieces										

Which number of studded pieces do you have the most of in your bag? _____

This is the **mode** for your Lego data. The mode is the value that appears the most frequently.

☞ Find the piece in your bag that has the most studs.

How many studs does this piece have? _____
This is the **maximum**. The maximum is the greatest number in a set of data.

☞ Find the piece in your bag that has the fewest studs.

How many studs does this piece have? _____
This is the **minimum**. The minimum is the smallest number in a set of data.

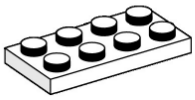
What is the difference between the maximum and the minimum?

_____ – _____ = _____
Maximum – Minimum = Range

The difference between the biggest and the smallest numbers in your data set is called the **range**. You subtract the minimum from the maximum of your data set.

Exploring Multiplication and Division with LEGOS

Lego Terminology Tip: A round peg on top of a Lego is called a "stud." We can name Lego bricks by their stud dimensions.



Warm up:
This piece has _____ studs. It is a ___ by ___ brick. This brick is also called a "flat" because it is very short. It is often used a building base for other bricks.

☞ Take a bag of mixed Lego bricks.

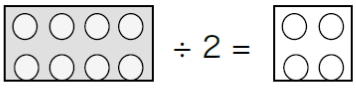
✏ How are Lego bricks similar to an **array**? _____

_____

_____

Find a brick with 6 studs. Draw the brick. What are the dimensions of the brick? _____	Find a brick with 12 studs. Draw the brick. What are the dimensions of the brick? _____
How many studs are on your largest brick? _____ Draw the brick. What are the dimensions of the brick? _____	Find a square brick. How many studs? _____ Draw the brick? What are the dimensions of the brick? _____

☑ ***Vocabulary:***
Dividend = The number in division that is being divided
Divisor = The number in division that divides another number. It tells you the number of parts.
Quotient = The result of dividing one number by another number.



Dividend ÷ Divisor = Quotient

Internet Resource List

LEGO Education Website: www.legoeducation.us

LEGO MoreToMath Curriculum Preview: http://www.le-partners.com/lego-education-moretomath-curriculum-preview-us/index.html

Scholastic Teacher Resources: http://www.scholastic.com/teachers/

Download LEGO worksheets by Alycia Zimmerman: http://www.scholastic.com/teachers/top-teaching/2013/12/using-lego-build-math-concepts

GoNoodle: https://www.gonoodle.com/

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For more information, contact:
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