



***What's My Value? Using "Manipulatives" and Writing to Explain Place Value***

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David Cox Road Elementary School

This curriculum unit is recommended for:  
Second and Third Grade Mathematics

**Keywords:** Place Value, manipulatives, amalgamate, Fusing Dots, exploding

**Teaching Standards:** See [Appendix 1](#) for teaching standards addressed in this unit.

**Synopsis:** This curriculum unit focuses on the use of essential and foundational place value concepts that students tend to lack when entering third grade. The purpose of this curriculum unit is to provide students with a deeper understanding of these place value concepts. By allowing students to participate in hands-on performance tasks and written explanations of the work they have completed, students will have a better understanding of the most foundational skills needed to understand place value. This curriculum unit utilizes the concept of Fusing Dots and using them as manipulatives to help students comprehend and explain the following: One- understanding the different “places” in a number and what the value is and means, two-how to represent numbers with manipulatives to add and subtract, and lastly, explain in writing HOW they solved a problem, and WHY the way the problem was solved worked.

*I plan to teach this unit during the coming year to 22 students in Third Grade Math.*

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## **What's My Value? Using "Manipulatives" and Writing to Explain Place Value**

*By: Amanda Donovan*

Place Value is said to be the most foundational mathematical skill and is crucial to developing number sense in young learners. Each year, I find students who are new to my classroom, are lacking basic place value concepts, such as combining 10 ones to make a ten, and 10 tens to make a hundred as well as being able to explain their steps to solving mathematical problems. I spend time at the beginning of each school year looking for different ways to help students recognize and comprehend place value concepts from previous years that have not been mastered. Many students require a year or more of 'catch-up instruction' which proves to be a difficult task when trying to teach and implement the grade level content required of a third grade student. Due to this, it is my objective to create a curriculum unit which not only helps students to comprehend these important concepts, but to also utilize hands on instructional strategies which allows students to see how the math actually works. I also plan on utilizing skills which allow students to explain, in detail, the process of place value when trying to solve problems.

### **Background Information**

Currently, I teach third grade at David Cox Road Elementary School (DCRES). We serve students in grades Pre-K through 5th. DCRES is located in the North Learning Community of Charlotte-Mecklenburg Schools, a large urban school district located in North Carolina. Our school consists of the following demographics: 72% African American, 10% Caucasian, 11% Hispanic, 3% Asian, and 4% other. At the end the 2013-2014 school year, our school became classified as a Title I elementary school. More than  $\frac{2}{3}$  of our student population live in what is considered the standard for poverty across our country. All students receive free breakfast and free lunch. Based on testing results at the end of the 2014-2015 school year, our school received a report card letter grade of "D". DCRES failed to meet growth expectations as set by the state of North Carolina and was considered a low performing school. This past school year, 2015-2016, DCRES met our expected growth expectations as set by the state of North Carolina, moved up a report card letter grade to a "C", and is no longer seen as a low performing school. The success in the past school year can be attributed to the data driven instruction (DDI) model and hard work by all staff members to implement this into our daily teaching.

Typical class sizes in my school range from 18-25 students per classroom. Currently, I have 18 students in a self-contained third grade classroom. One student has an Individualized Education Plan (IEP), and one student receives English Language Learner (ELL) services. Both of these students receive accommodations on state, local and classroom assessments, such as read-aloud, separate settings and extended time.

Within our school, students in grades K-5 partake in numerous reading and math assessments. These include: Measures for Academic Progress (MAP), district wide interim assessments, and the North Carolina End-of-Grade Tests (EOG). In addition, students in grades K-5 also participate in MCLASS assessments to evaluate students' reading habits. Most students entering our classrooms each year are considered to be "below grade level" in areas of reading and math based on these numerous measures. Even though I am responsible to teach students the third grade curriculum, I must also find unique ways to fill the knowledge gap for the majority of my students. Without this knowledge, students have a difficult time understanding basic concepts which are needed to be successful throughout their academic career.

Our current reading curriculum follows a *Balanced Literacy* approach. Daily, students and teachers participate and interact with the following components: read aloud, guided reading, independent reading, close reading, daily mini lesson, sharing, conferring, and word work. Our current math curriculum, which was adopted by the school district is *Investigations*, however we spend most of the time supplementing this curriculum with other resources, mainly *EngageNY* or *Eureka Math* as it is commonly referred to. *EngageNY* is a curriculum developed out of New York State, which connects math to the real world, while also reducing gaps in student learning, building confidence in students to problem solve and prepare students to understand more advanced math.

By using a variety of resources, it allows us to better reach the needs of all students in order for students to master skills as required by the Common Core Standards. Our district assessments, class common assessments, daily exit tickets and teaching points are all aligned to the Scope and Sequence and Pacing Guides that not only the district provides, but also that the teachers and facilitators at our school have manipulated to create the most rigorous teaching practices for students.

## **Content Standards**

The state of North Carolina adopted the national Common Core State Standards for Math during the 2012-2013 school year. At first, there was an instantaneous struggle to implement the new curriculum. The new standards were much more rigorous than the prior standards used to teach students and created huge complications when trying to fill academic gaps. Due to this, and the fact that many of our students are already considered to be "below grade level", I am often spending time integrating math standards from first, second, and third grade in my classroom. Below, I will also reference the Standards for Mathematical Practice, which are integrated into my daily teaching.

The following are the Common Core State Standards for Math and Standards for Mathematical Practice in which this unit will focus on. These standards are taken directly from the *Common Core State Standards Initiative* document. These are the common core

standards that focus on or around place value foundational skills. It is my belief that students need a solid understanding of place value skills in order to continue being successful with the third grade curriculum. It is the expectation that this unit will help students comprehend the foundational skills of place value while also being able to implement that knowledge into grade level curriculum.

*CCSS.Math.Content.3.NBT.A.1*

*Use place value understanding to round whole numbers to the nearest 10 or 100.*

This standard addresses the part of place value in which students should be analyzing numbers and their value. Since so many students enter third grade still not knowing the difference between the place a number is in and the value of the number, this standard can be hard to master. In this curriculum unit, students will go back to the essentials while still learning the content at a third grade level using information created by James Tanton, a research mathematician who uses the action of “Fusing Dots”, which is a similar activity to the use of base ten blocks, which are introduced in the first grade curriculum. “Manipulatives are motivating and conducive to concrete kinds of learning”<sup>1</sup> so it is imperative to incorporate them into daily instruction.

*CCSS.Math.Content.3.NBT.A.2*

*Fluently add and subtract within 1000 using strategies and algorithms based on place value, properties of operations, and/or the relationship between addition and subtraction.*

Students will show proficiency with this standard after they manipulate with “Fusing Dots”. Upon completion, student should have a firm understanding of how to add and subtract within 1,000 and be able to explain how they added to compose new tens and new hundreds and subtracted to decompose bundles of tens and bundles of hundreds. Students will explain their work in connection with “Fusing Dots”, observing that as readers we read from left to right, so to do math, we can complete it from left to right as well. Students will understand and show mastery with the idea that when “fusing dots”, or composing and decomposing ones, tens and hundreds, that numbers with more than 10 ones, 10 tens, or 10 hundreds ‘explode’ in order to carry or borrow a ten to the next place value to the left. With this knowledge and practice, students should be able to easily add and subtract 3 digit numbers to not only become fluent mathematicians, but to gain foundational knowledge to support learning about multiplication and division.

*CCSS.Math.Content.3.NBT.A.3*

*Multiply one-digit whole numbers by multiples of 10 in the range 10-90 (e.g.,  $9 \times 80$ ,  $5 \times 60$ ) using strategies based on place value and properties of operations.*

In order to gain proficiency with multiplication, students need to understand how to add and subtract, as previously mentioned above. With this standard, students will see the

correlation between multiples of 10 and how “Fusing Dots” creates new ones, tens and hundreds.

### Standards for Mathematical Practice

*MP.1 Make sense of problems and persevere in solving them.*

*MP.2 Reason abstractly and quantitatively.*

*MP.3 Construct viable arguments and critique the reasoning of others.*

*MP.4 Model with Mathematics*

*MP.5 Use appropriate tools strategically.*

*MP.6 Attend to precision.*

*MP.7 Look for and make sense of structure.*

*MP.8 Look for and express regularity in repeated reasoning.*

### **What is Place Value?**

Place value continues to be the most introductory concept for mathematicians. Without it, the understanding of numbers and their values would be non-existent. Doris Gluck stated that “place value is so necessary for long multiplication, long division, fractions, decimals and even algebra”.<sup>2</sup> Place value is the most fundamental concept students will learn, so it is imperative it is taught well and mastered in order for students to move on in mathematical learning. When students begin to learn about numbers, we start with counting, mainly from 1-10. Before students even enter school, most parents have introduced some type of counting within the home. All children learn numbers, but mostly through the strategies of memorization.



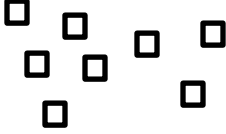
As children get older and enter the school system, they begin to learn that numbers are not simply shapes, but that they have meaning, and value. In the early elementary years, students are introduced to the visual representation of a place value chart in which they learn to model their mathematical thinking of numbers with pictorial representations. These drawings can be modeled with base ten block drawings, and even with numbers in each place on the place value chart.

During this unit, we will use the place value chart, or mats as they can also be referred to as, base ten blocks, and a method of “Fusing Dots” as a means to help students expand their knowledge of numbers, their values and how to ‘do the math’.

### **What is a Place Value Chart?**

Place value chart with base ten blocks as a pictorial representation:

Example: 428

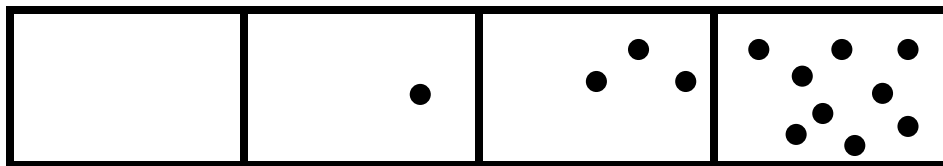
Hundreds	Tens	Ones
		

A place value chart can be something as simple as a sheet of paper, split up into each ‘place’ of a number. For this curriculum unit, the place value chart will consist of hundreds, tens and ones. Lines will separate each column so students are able to place manipulatives in each section of the chart to correctly represent numbers. First, students will need to have knowledge of place values and the value of each number within that place. Next, students will learn that when using a place value chart, as we move from right to left, the value of any given digit becomes larger. For each place value we move, a digit will become ten times larger (ie. 10 ones, becomes 1 ten, 10 tens becomes 1 hundred). This process can be referred to as bundling, composing or amalgamating numbers, as we will later learn when discussing Fusing Dots. The same process happens when you move from left to right; then numbers become smaller. This is known as unbundling, decomposing, or exploding, again, which will be discussed when working with Fusing Dots.

### What are Fusing Dots?

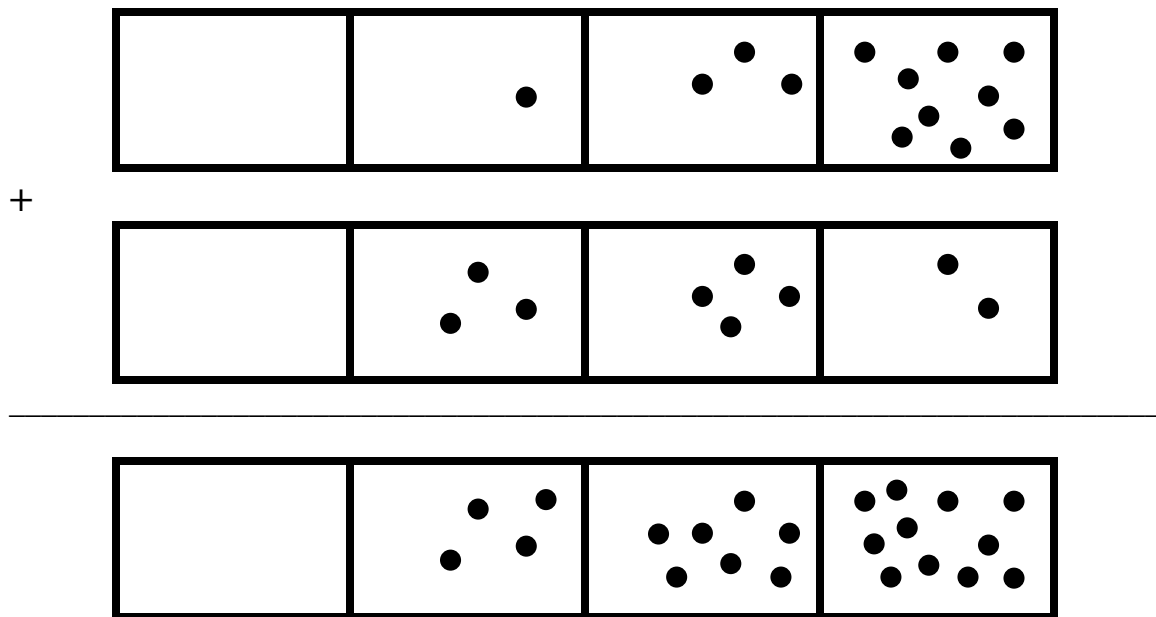
Fusing Dots is a concept that was presented in my current seminar class by our Professor, Harold Reiter of The University of North Carolina at Charlotte (UNCC). The idea was originally produced by Jim Tanton of St. Marks School. Fusing Dots is a simple idea with complex work that looks similar to the Place Value Chart and can be manipulated in a similar fashion. Because the Fusing Dots strategy is so similar, it is important to introduce the Place Value Chart to students first and have them gain mastery, before introducing a much more complex strategy. For the purpose of this unit, we plan to utilize the simplest forms of this idea, even for the higher level students in the classroom.

Fusing Dots is an idea similar to that of the Place Value Chart and the use of base ten blocks, except using dots. You utilize these dots to create a number in the place value chart, like so:

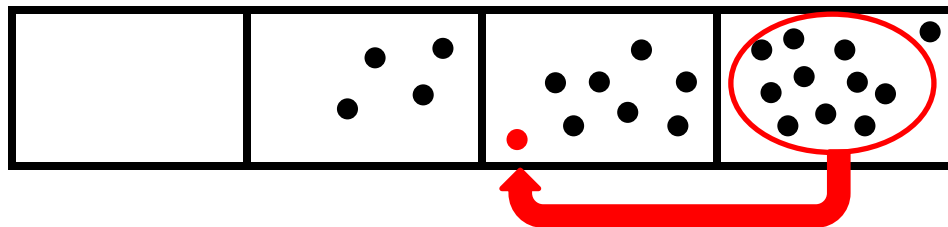


The Fusing Dots model shown above shows 1 hundred, 3 tens, and 9 ones. This is the same as writing  $100 + 30 + 9 = 139$ . This way of manipulating numbers allows students to see and write numbers in multiple ways; standard, expanded, and written form.

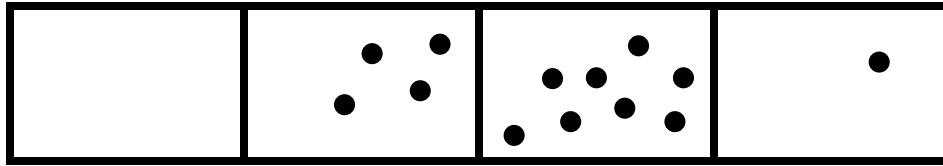
Fusing Dots permits students to amalgamate, or fuse together, more than one number at a time. The example below shows what adding  $139 + 342$  would look like:



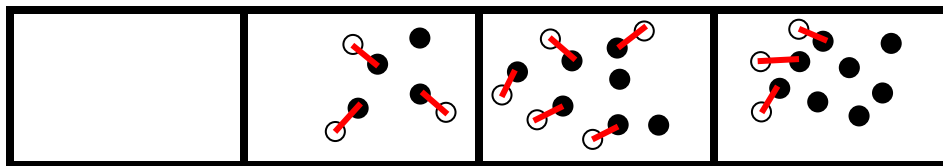
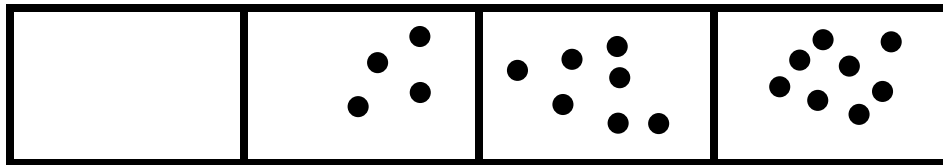
In looking at the Fusing Dots addition problem above, it shows that when we amalgamate the numbers, we are left with a picture showing 11 ones, 7 tens and 4 hundreds. Since we know that 10 ones makes 1 ten, we need to fuse dots together to make a new ten and move it where it belongs in the picture. See below for how this works:



When fusing together ten ones to make 1 new ten, we end up with the Fusing Dots model below, which gives us a final answer of 4 hundreds, 8 tens and 1 one. This can also be written as 481,  $400 + 80 + 1$  or four hundred eighty one.



The idea of Fusing Dots is important, especially when introducing the idea of subtraction to students. Using Fusing Dots to subtract is very similar to the addition model, however, when we refer to amalgamating dots in subtraction, we call these “anti-dots”. The example below shows how this would look for the subtraction problem of  $478 - 353 = 125$ :



In the above example, we have amalgamated the numbers and the second number became anti-dots rather than a dot. The anti-dot can be recognized by the dot that is not filled in, while the dot is completely black. The next step will allow for students to ‘get rid of all the dots’. Students will need to ‘cancel’ or cross out every dot that has an attached anti-dot, until they no longer have anything to cancel

There are times when we will be left with answers where we have a negative number in the ones or tens place. This meaning, we have more anti-dots than dots, which cannot happen. When this happens, we need to “explode” a hundred to make 10 tens or 1 ten to make 10 ones. This process will permit us to cancel out an anti-dot. This awareness of fusing and exploding dots let students and adults alike see the relationship between place value and how numbers work.



## **Teaching Strategies**

### Manipulatives

Students are and will continue to be encouraged to use mathematical tools throughout this unit. Manipulatives are hands on materials that allow students to physically move object to ‘see the math’ happening in front of them. They have been introduced to many different types and manipulatives to use during mathematical instruction. These manipulatives include, but are not limited to: small whiteboards, place value charts or mats, base ten blocks, fusing dots chart, fusing dots (chips) and any other manipulatives that are in the classroom.

### Exit Tickets

As a culminating ‘assessment’ at the end of each performance task, or daily activity, students will be asked to explain their understanding of the day’s lesson. This could be as simple as drawing a picture, or a written explanation of how they solved a problem. This should not take students more than 5 minutes to complete and this data will be used to inform instruction in upcoming lessons. Each exit ticket is scored immediately and students who have not mastered the specific skill will work with the teacher in a re-teach group in order to get a more informal understanding of a concept.

### Math Notebooks

Students will use math notebooks to develop written responses to performance tasks covered in this curriculum unit. These notebooks will be used to assess students’ understanding of taught content in the written form. Math notebooks are also utilized for students to complete their work in. Students have access to notes taken in class as well as previous work in order to ensure they are referencing prior work to help support their understanding of a particular concept.

## **Classroom Activities/ Performance Tasks**

### Activity #1: Places and Their Values/ Adding and Subtracting on the Place Value Chart (2 days)

Materials (See [Appendix #2](#) for complete list of unit materials): Skittles (15 per student), place value chart (1 per student, see [Appendix #3](#)), sandwich bags, math notebook, pencil

Day One: On the introductory day of this unit, students will take their previous knowledge of the place value chart, how we use it, and how base ten blocks are used to represent numbers. Instead of using base ten blocks to represent numbers, students will be using Skittles candy. Each color will correspond to a particular place on the place value chart.

Write the following correlations on the board:

- Red and orange will represent numbers in the ones place
- Green and yellow will represent numbers in the tens place
- Purple will represent numbers in the hundreds place.

Instruct students to empty their bag of skittle and place them accordingly on their place value chart. The chart below represents the colors of the Skittles visually represented for students who may have trouble identifying which Skittles go where on their place values chart.

Hundreds	Tens		Ones	

As students are working on placing their Skittles on their place value chart, have them start thinking about what number they have represented. Students should also make sure they are ‘bundling’ any ones where they have ten or more Skittles represented, or any tens where they have ten or more Skittles represented. Upon completion of placing the candies on the chart, students will draw their final number representation on their place value chart in their math notebook. Continue this activity multiple times (2-3 more times). Students will switch their bag of candies with another group member and repeat the same processes (placing the Skittles on the chart, drawing the pictorial representation in their math notebook).

Students will answer the following question in their math notebook at the completion of the lesson:

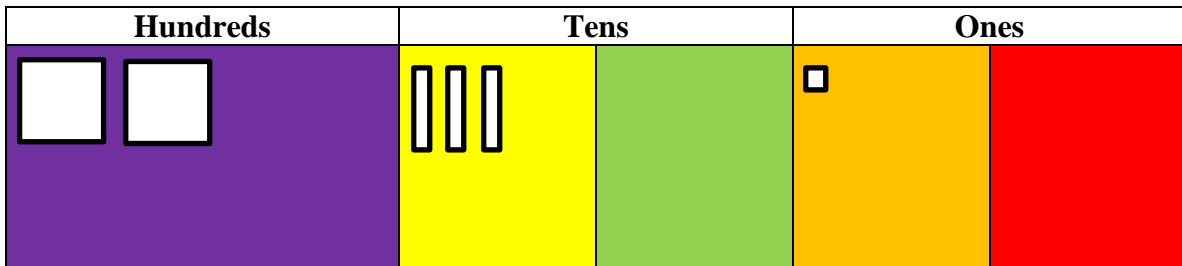
- *What happens when I have 10 or more ones? What about 10 or more tens?*
- *What process did you have to complete when this happened?*
- *What do you notice about the number you wrote when you had to bundle 10 ones or 10 tens?*

Day Two: All students should have the same materials as yesterday (bag of Skittles, place value mat, math notebook, pencil). Students will start today’s class with a review of yesterday’s task.

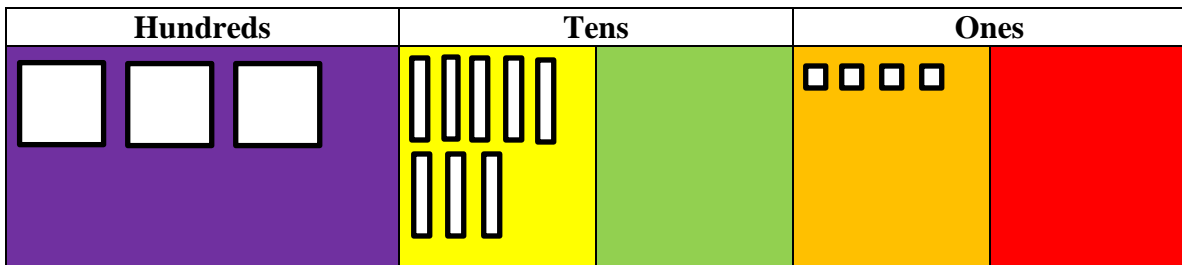
Today, students will work in pairs to add and subtract three digit numbers using their Skittles and place value chart. First, students will represent a number based on the Skittles in their bag. Students will draw their place value chart in their math notebook along with the correct number of ones, tens and hundreds. Then, students pair up with a partner and analyze their partners place value chart.

Once students have paired up, they will add their values together. Students should each take their individual amount of Skittles and combine them on ONE place value chart. Students should bundle ones and tens as necessary. Once they have bundled their values together, student will draw the new amount on the place value chart in their math notebook. Students should also write the addition equation they used to add their values together. An example of the expectation can be seen below:

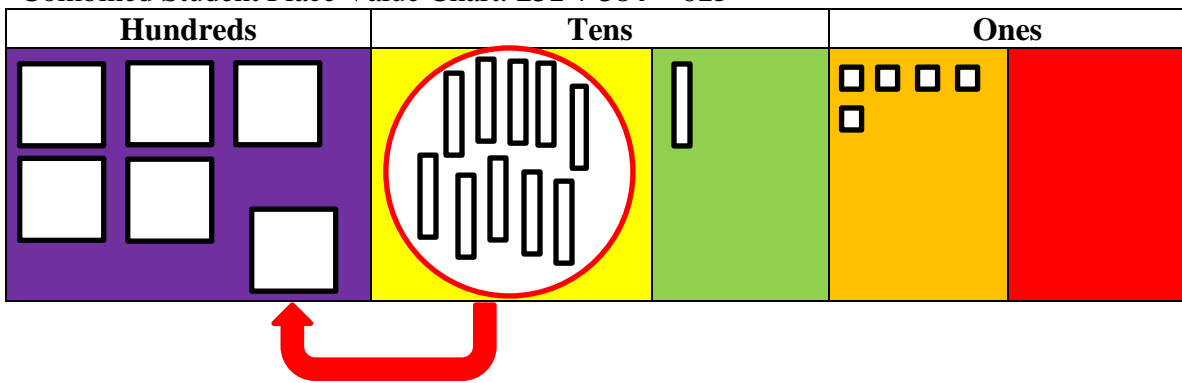
Student 1 Individual Place Value Chart: **231**



Student 2 Individual Place Value Chart: **384**



Combined Student Place Value Chart: **231 + 384 = 615**



After students work together to add their values together, they will then use the same amounts of Skittles to subtract. Students will represent the same number they used when adding to subtract. After students have visually represented their number with Skittles on the place value chart, they will draw a copy in their math notebook with the correct number of ones, tens and hundreds. After, students pair up with the same partner to subtract the smaller number that is represented.

Students should each take their individual amount of Skittles and decide who has a bigger number. The smaller number will be the amount being subtracted. Students should unbundle hundreds and tens as necessary. This will be represented in the drawing of their place value chart by drawing a line through the amount of hundred, tens and ones being subtracted. Once they have unbundled their values together, student will draw the new amount on the place value chart in their math notebook. Students should also write the subtraction equation they used to subtract their values together. An example of the expectation can be seen below:

Student 1 Individual Place Value Chart: **231**

Hundreds	Tens	Ones

Student 2 Individual Place Value Chart: **384**

Hundreds	Tens	Ones

Combined Student Place Value Chart: **384 – 231 = 153**

Hundreds	Tens	Ones

Day Two Exit Ticket: Create a place value chart and draw a representation of the following addition and subtraction problems:

1.  $394 + 262 =$
2.  $536 - 456 =$

Activity #2: Adding and Subtracting with Fusing Dots (2 days)

Materials (See [Appendix #2](#) for complete list of unit materials): Fusing Dot Chart (see [Appendix #3](#)), colored counters, sheet protectors, dry erase markers, number cards (0-9), sandwich baggies, Skittles, math notebook, pencil

Day One: When introducing Fusing Dots, link the knowledge students already have about base ten blocks. Since base ten blocks are represented by small cubes (ones), long skinny blocks (tens) and large square blocks (hundreds), students already understand which blocks go in which part of the place value chart.

We are going to use a chart similar to the place value chart when working with Fusing Dots. The difference will be in how we represent our numbers. All numbers (ones, tens and hundreds) will be represented with round dots. Give each student a copy of the Fusing Dots Chart. It is recommended to laminate the student charts, or put each chart in a sheet protector so that students are able to reuse as needed. Students can use Skittles from the previous lesson or colored counters to help them visualize the dots.

Introduce the term amalgamating to students. Amalgamating means to combine. Tell students when we add numbers using Fusing Dots, we represent this in a diagram as amalgamating numbers, meaning we add the numbers we are representing. This means the same as bundling, which is a concept students are already familiar with. Begin the lesson by modeling how to add using Fusing Dots and amalgamating. Pull three number cards out of a bag. The first number pulled represents the number of ones, the second number represents the tens, and the third number represents the hundreds. For this example, pull a 5 (hundreds), 8 (tens) and 3 (ones). Show students how to draw the dots in each part of the chart (see an example of what this looks like in the prior section about Fusing Dots). After you have modeled, pass bags of numbers out to partners of students. Each student will pull three number cards out of the bag and will draw the dots that represent each value on their template with a dry erase marker. Have students show their partner their work as a check. Allow students to practice this skill until you feel they have mastered it.

After each student has successfully mastered representing numbers in the dots format, engage them in how we will add the Fusing Dots together to create an addition problem. Model this by using the same three cards as before (5, 8, 3) and pull 3 more cards (2, 5, 5) out of the bag. Show students how to represent this problem using the Fusing Dots method (see an example of what this looks like in the prior section about Fusing Dots). Students will then work with a partner to add each of their three digit

numbers and represent the math with an equation. Students will draw their addition equation and Fusing Dots in their math notebook.

Day One Exit Ticket: Give students the following equation:  $476 + 468 = \underline{\quad}$ . Students will solve this equation using the Fusing Dots Method of amalgamating.

Day Two: Review with students what Fusing Dots are and their similarities and differences to base ten blocks. Today, we are going to use the Fusing Dots Chart to subtract, or explode the dots. It is recommended to laminate the student charts, or put each chart in a sheet protector so that students are able to reuse as needed.

Introduce the term exploding to students. Exploding means to break apart. Tell students when we subtract using Fusing Dots, we explode numbers. This means the same as unbundling, or decomposing, which is a concept students are already familiar with. Begin the lesson by modeling how to subtract using Fusing Dots and exploding the dots. Pull three number cards out of a bag. The first number pulled represents the number of ones, the second number represents the tens, and the third number represents the hundreds. For this example, pull a 7 (hundreds), 3 (tens) and 8 (ones). Show students how to draw the dots in each part of the chart (see an example of what this looks like in the prior section about Fusing Dots). After you have modeled, pass bags of numbers out to partners of students. Each student will pull three number cards out of the bag and will draw the dots that represent each value on their template with a dry erase marker. Have students show their partner their work as a check. Allow students to practice this skill until you feel they have mastered it.

After each student has successfully mastered representing numbers in the dots format, engage them in how we will subtract the Fusing Dots together to create a subtraction problem. Model this by using the same three cards as before (7, 3, 8) and pull 3 more cards (2, 6, 9) out of the bag. Show students how to represent this problem using the Fusing Dots method (see an example of what this looks like in the prior section about Fusing Dots). Students will then work with a partner to subtract the smaller three digit number from the larger three digit number. They will represent the math with an equation. Students will draw their subtraction equation and Fusing Dots in their math notebook.

Day Two Exit Ticket: Give students the following equation:  $846 - 379 = \underline{\quad}$ . Students will solve this equation using the Fusing Dots Method of exploding.

Activity #3: How did you solve your problem? Why did it work? (1 day)

Materials (See [Appendix #2](#) for complete list of unit materials): Fusing Dots Create A Problem (see [Appendix #3](#)), pencil, number cards (0-9), sandwich baggies

Today's lesson will link student's ideas of Fusing Dots and add in a written component to math. Model how to create a Fusing Dots word problem using the equations from the

previous addition and subtraction exit tickets (day one:  $476 + 468 = \underline{\quad}$ , day two:  $846 - 379 = \underline{\quad}$ ). For example, an addition word problem to represent  $476 + 468 = \underline{\quad}$  may say: ‘Harris Teeter got a delivery of 476 red apples and 468 green apples yesterday. How many apples did Harris Teeter have delivered in total?’ After writing the word problem, show students how to draw the Fusing Dots, amalgamating when necessary, to represent the work (see an example of what this looks like in the prior section about Fusing Dots). Repeat the same process for the subtraction equation of  $846 - 379 = \underline{\quad}$ . An example of a word problem may say: ‘Dunkin Donuts made 846 donuts yesterday. They only sold 379 donuts to customers. How many donuts were unsold?’ After writing the word problem, show students how to draw the Fusing Dots, exploding when necessary, to represent the work (see an example of what this looks like in the prior section about Fusing Dots).

Students will work with partners to create both an addition and subtraction equation, word problem and pictorial representation using Fusing Dots. Students will pull six number cards out of the baggie to represent two 3-digit numbers for their addition work, and will repeat this process to create two 3-digit numbers for their subtraction work. Remind students about amalgamating dots when adding, and exploding dots using an anti-dot during subtraction. Pairs of students complete the Fusing Dots Create A Problem assignment. This will serve as their exit ticket for today.

#### Activity #4: Fusing Dots Assessment (1 day)

Materials (See [Appendix #2](#) for complete list of unit materials): Fusing Dots Assessment (see [Appendix #3](#)), pencil

As a culmination of learning about Fusing Dots, students will complete an assessment showcasing their knowledge of how to add and subtract using Fusing Dots.

## **Appendix 1: Implementing Teaching Strategies**

*CCSS.Math.Content.3.NBT.A.2*

*Fluently add and subtract within 1000 using strategies and algorithms based on place value, properties of operations, and/or the relationship between addition and subtraction.*

Students will show proficiency with this standard after they manipulate with “Fusing Dots”. Upon completion, student should have a firm understanding of how to add and subtract within 1,000 and be able to explain how they added to compose new tens and new hundreds and subtracted to decompose bundles of tens and bundles of hundreds. Students will explain their work in connection with “Fusing Dots”, observing that as readers we read from left to right, so to do math, we can complete it from left to right as well. Students will understand and show mastery with the idea that when “fusing dots”, or composing and decomposing ones, tens and hundreds, that numbers with more than 10 ones, 10 tens, or 10 hundreds ‘explode’ in order to carry or borrow a ten to the next place value to the left. With this knowledge and practice, students should be able to easily add and subtract 3 digit numbers to not only become fluent mathematicians, but to gain foundational knowledge to support learning about multiplication and division.

*CCSS.Math.Content.3.NBT.A.3*

*Multiply one-digit whole numbers by multiples of 10 in the range 10-90 (e.g.,  $9 \times 80$ ,  $5 \times 60$ ) using strategies based on place value and properties of operations.*

In order to gain proficiency with multiplication, students need to understand how to add and subtract, as previously mentioned above. With this standard, students will see the correlation between multiples of 10 and how “Fusing Dots” creates new ones, tens and hundreds.



## **Appendix #2: Materials for Classroom Use**

1. Skittles (15 per student)
2. Place value chart (1 per student)
3. Sandwich bags
4. Math notebook
5. Pencil
6. Fusing Dot Chart
7. Colored counters
8. Sheet protectors
9. Dry erase markers
10. Number cards (0-9)
11. Daily exit tickets
12. Fusing Dots Assessment

### Appendix #3: Student/ Teacher Resources

#### Activity #1 Student Place Value Chart

Hundreds	Tens		Ones	

#### Activity #2 Fusing Dots Chart

Thousands (if needed)	Hundreds	Tens	Ones





Activity #4 Fusing Dots Assessment

Directions: Using the given equations, draw the Fusing Dots to represent the mathematical thinking.

1.  $396 + 475 = \underline{\hspace{2cm}}$

Thousands (if needed)	Hundreds	Tens	Ones

2.  $748 - 469 = \underline{\hspace{2cm}}$

Thousands (if needed)	Hundreds	Tens	Ones

3.  $602 + 397 = \underline{\hspace{2cm}}$

Thousands (if needed)	Hundreds	Tens	Ones

4.  $407 - 234 = \underline{\hspace{2cm}}$

Thousands (if needed)	Hundreds	Tens	Ones

Directions: Using the given sets of Fusing Dots, write the equation that matches pictorial representation.

5. Equation:  $\underline{\hspace{10cm}}$

Thousands (if needed)	Hundreds	Tens	Ones

6. Equation:  $\underline{\hspace{10cm}}$

Thousands (if needed)	Hundreds	Tens	Ones

## Notes

1. Ross and Kurtz, *Making Manipulatives Work: A Strategy for Success*, 256.
2. Gluck, Doris H., *Helping Students Understand Place Value Arithmetic Teacher*, 10.

## Annotated Bibliography

Altieri, Jennifer L. 2009. "Strengthening Connections Between Elementary Classroom Mathematics and Literacy". *Teaching Children Mathematics* 15 (6). National Council of Teachers of Mathematics: 346–51. *This resource offers teachers a multitude of ways to incorporate literacy into the mathematics classroom. One example being the use of exit tickets, which I currently use and plan to use throughout the performance tasks in this curriculum unit.*

"A New Curriculum for a New Day." Great Minds. Accessed September 11, 2016. <http://greatminds.net/maps/math/home>. *This website is a great resource for teachers and parents. It allows both groups of people to see exactly what is expected of students, allowing consistency in the understanding of the mathematical content.*

Burris, Justin T. 2013. "Virtual Place Value". *Teaching Children Mathematics*. 20 (4). *This article demonstrates how students learn place value through the use of concrete base ten blocks and virtual base ten blocks, allowing for technology to be integrated into the classroom.*

Gluck, Doris H. 1991. "Helping Students Understand Place Value". *Arithmetic Teacher*. 38 (7): 10-13. *This article showcases the importance of using concrete materials to engage students in the understanding of place value.*

<https://www.youtube.com/watch?v=osebRI5CPB4>. "Exploding Dots Lesson 1\_4 Tanton." YouTube. 2013. Accessed September 11, 2016. <https://www.youtube.com/watch?v=osebRI5CPB4>. *This video is a great resource for teachers to watch in order to understand how to correctly add using the fusing dots model.*

<https://www.youtube.com/watch?v=rSo9JDhg-Eo>. "Exploding Dots Lesson 1\_5 Tanton." YouTube. 2013. Accessed September 11, 2016. <https://www.youtube.com/watch?v=rSo9JDhg-Eo>. *This video is a great resource for teachers to watch in order to understand how to correctly subtract using the fusing dots model.*

Neuschwander, Cindy, and Wayne Geehan. 2009. *Sir Cumference and all the king's tens: a math adventure*. Watertown, MA: Charlesbridge.

Reiter, Harold. "Fusing Dots, Antidots and Black Holes." Harold Reiter's Home Page. Accessed September 11, 2016. <http://math2.uncc.edu/~hbreiter/CTI2015/>. *This is a great resource for teachers who really want to understand the concept of Fusing Dots and how to appropriately teach their students this model. Harold was our CTI seminar leader and helped us explore the use of this content during many seminars.*

Ross, Rita, and Ray Kurtz. 1993. "Making Manipulatives Work: A Strategy for Success". *Arithmetic Teacher*. 40 (5): 254-57. *This resource offers teachers different option for how to incorporate and have students use math manipulatives in the classroom.*

"Standards for Mathematical Practice." Standards for Mathematical Practice. Accessed September 11, 2016. *This is another great resource for the standards that are practiced in mathematics classrooms around the nation.*