

What's in a Number? Basic Number Bonds and Place Value

Kristin M. Arko

Content Objective:

The purpose of this unit is to give kindergarten students multiple, hands on strategies to explore a variety of ways a number can be constructed. The unit will allow children to compose numbers up to 20 in different ways through dramatic play, artistic representation, and verbal explanation. This correlates with common core standards K.OA.3 and K.NBT.1, which focus on algebraic thinking and numbers and operations in the base ten model.

This unit also focuses on incorporating 21st century skills, specifically communication and collaboration, into the core subject of mathematics. Most activities require students to communicate and collaborate with others about their thinking. Scholars are asked to walk through problems with a peer and complete tasks together using strategies that require dialogue. Students also communicate to the class what they have worked on and explain their logic behind the solutions they derived from a given project. Collaboration is crucial as students engage in discussions explaining the multiple outcomes for each task.

Number bonds offer an in-depth look at what composes each numeral. This leaves a wide range of opportunities for learners to explore, discover, and discuss. To promote these opportunities, the main strategies in this unit will be whole group modeling, independent or small group practice, and synthesizing information through discussion. The strategies taught to students will first be modeled for the whole group by the teacher. These ideas will then be put into practice by the students in small groups or partners to practice. The activities can be repeated throughout the year in centers or individual practice. Students will then use their experiences to synthesize, discuss, and compare number bonds.

This unit will be taught as a supplement to the Math Investigation curriculum implemented by Charlotte Mecklenburg Schools. Because of the wide range of learners in a typical kindergarten classroom, the activities will begin with simple one-to-one correspondence activities and build up to making numbers up to 10 in multiple ways (i.e. $2+3=5$ AND $1+4=5$). Higher level students will be encouraged to do the same activities through 20. All students will be encouraged to show number combinations through multiple medias. In dramatic play they will do activities such as completing a grocery list

to find a value. Artistically they will use materials like pom pom balls to show variables that equal a sum. In addition to the hands on materials, the students will be asked to explain what they did or to explain their thinking to a friend to monitor understanding and complexity of thinking.

While the unit has been created for Kindergarten students these activities could be used for any kinesthetic learner struggling with number sense in first or second grade. In second grade some of the activities would be a great way to introduce place value if the numbers were modified to two digit numbers.

Rationale:

Number sense is the first idea that students are introduced to when they start school. However, number sense is not always common sense, especially to a young learner who is just learning to count. It is a concept that many continue to struggle with as they go through elementary school. While much of math is linked to patterns, the wording is not always the same. Just the other day as my kindergarteners were counting on the calendar we got to the number 29. What comes after 29 I asked? 2010! Someone shouted, so proud of himself for remembering the pattern that after 9 must come 10. So began the conversation of groups of 10 and a brief introduction to place value. The same often happens when we count. Many children will say “Ten, eleven, twelve, thirteen, fourteen, fiveteen.” Just like we must be careful how we teach children to say numbers, we must be equally careful how we teach them to *understand* numbers. We need to be sure they have a grasp of what the value of a digit truly is.

Traditional math programs rely on memorizing facts to complete higher level equations and to “master” or pass a math course. In today’s world, students are expanding their knowledge to encompass 21st century skills such as problem solving and group work. Math is no longer memorization but a combination of explanation and understanding. Because we are moving away from memorization, it is crucial that students begin to manipulate numbers at an early age to build a foundation of algebraic thought and number sense. By beginning to verbalize math ideas while showing work, students will not only develop a strong mathematical foundation but they will learn tools to use later in their schooling such as critical thinking skills, place value concepts, and establishing an academic vocabulary for communication. All of these skills are crucial in building self confidence in young learners that they can indeed solve higher level problems.

This unit has been designed to be completed by children using cost efficient materials. Every activity has items that can be purchased at Wal-Mart, Target, etc. They are easy to find year round and many are items you already have in your classroom. All tasks are genuine work samples and so they are colorful, tactile, and easily made by children of all developmental stages.

Teaching Strategies:

Early learners are typically active and eager to be engaged in hands on experiences. Children are also excited to demonstrate what they know, tell peers about their discoveries, and proud to show their work to others. This unit encourages each of these through a variety of teaching strategies.

Whole Group Modeling: I'd like each session to begin with the group sitting in a circle so each child can see the teacher and fellow peers. This allows students to see each other as equals and promotes conversation. The teacher will lead the session as a facilitator by modeling different activities. The teacher will model using content rich vocabulary and encourage students to do the same. Once the teacher has modeled, a student volunteer will contribute or add to the activity. This would be the "engage" part of the daily lesson.

Independent Practice: Independent or group practice allows students to explore numbers through the activities listed below. All independent activities build on concepts presented during whole group modeling or are based on prior knowledge from previous tasks. The activities have been designed with centers in mind but could be customized based on classroom and individual needs. For example, some children might work in small groups with a teacher if they are struggling. Activities could also be done in peer groups matching a higher level learner leading a lower level student. Once taught the games and activities could also be repeated for morning work or homework to reinforce number sense and counting skills.

Closing Circle: At the end of each session I'd like the class to come back together. I envision students showing and explaining what they worked on. I'd also like to hear dialogue amongst the students. They should be discussing what they worked on during the session and how their work was similar or different than others. This would show higher level thinking and explanation as they synthesize multiple sets of student data and relate it to their own. The easiest way to begin this kind of synthesis would be through the dramatic play activities. Dialogue should be prompted by a simple, open ended question from the teacher. Possible closing circle prompts include:

- What did you build today?
- What did you notice about your number building today?
- What was the largest value you worked with today?
- Were your combinations the same or different as your friends? Why do you think that is so?
- Why does each value have so many different combinations?

- What do the numbers X and Y have in common? How are they different?

Dramatic Play with a Purpose: Eight hours is a long time for five and six year olds to sit still and learn. This unit allows students to get up and move to keep their minds active. During many of these lessons students will be asked to act out math scenarios. This caters especially to kinesthetic learners who benefit from hands on learning. For an even greater benefit, the scenarios will be real life examples of math they will see every day in their lives from the classroom and their community.

Classroom Activities:

Routine is important for children to feel safe enough to take risks in their learning. Therefore, each day should run in the same sequence. The only major change should be the exploration activity or the center activities. The sequence should begin with whole group modeling, proceed to exploration activities or centers, and conclude with a closing circle to synthesize the day's learning. The whole group and closing circle routines are outlined in the teaching strategies section.

This unit includes nine explicit activities for students to complete in small groups or learning centers. Each activity provides a work sample for students to keep or a recording sheet to document strategies used. The activities are designed to incorporate visual and kinesthetic learning and promote creativity through art and drama. Activities are easily differentiated by choosing either single digit numbers for lower level learners or double digit numbers for higher level learners who are ready for a challenge.

There are also two culminating activities to provide closure for the unit. The first is a gallery walk that can be used as an assessment. The second is a Number Museum which gives students a chance to present their work to other classes and adults and celebrate their learning.

Building a Ten's Stick

The purpose of this activity is twofold. The primary goal is for students to work on counting with one to one correspondence. The secondary goal is to build a foundation of the number ten. The materials needed in this activity are large craft sticks and pompom balls or cotton balls. The pompom or cotton balls should be all one color for each child. The child will count ten balls out from a container or bag to show a mastery of one to one correspondence. They will then glue these onto the craft stick. This stick is kept in a toolbox to be used as a reference for the student. It can be used to practice counting on. It can also be used to represent a "ten" for students who are building numbers greater than 10. To show 14 for example they can use their ten's stick and four single pompom balls. This can be adapted for higher level learners through the creation of multiple tens sticks. For example, to show the number 32 they can use three tens sticks and two single

pompoms. This activity aligns with the Common Core strand Counting and Cardinality. Figure 1 shows an example of this task.

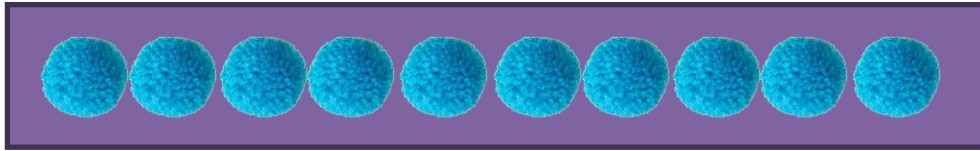


Figure 1

Building Numbers Center:

The purpose of this activity is to decompose numbers into a variety of pairs or addends. This activity also gives students the chance to work on their one to one correspondence. Students will use a variety of classroom materials or art supplies to build Today's Number in as many different combinations as possible. Today's Number can be given by the teacher or students can draw a card from a deck of primary numbers written on index cards. The number will be written in the middle of either large construction paper or butcher paper. Students then record the combinations by attaching art materials or drawing with markers around the number. The number will be written in the middle of either large construction paper or butcher paper. Some ideas for materials include stickers, packing peanuts, short pipe cleaners, pieces of yarn, or pictures drawn with markers. Figure 2 shows an example of this task.

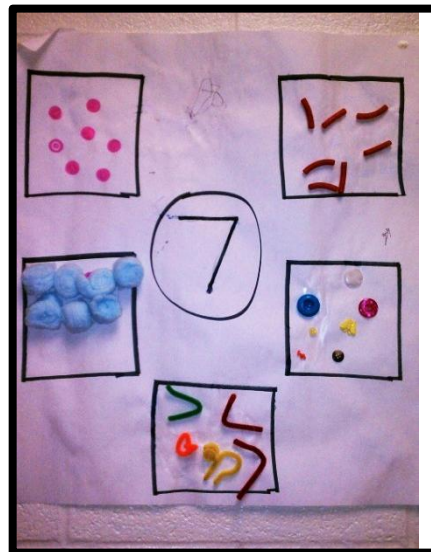


Figure 2

Number Bond Strips:

All Learners: The purpose of this activity is to decompose numbers into a variety of pairs or addends. Students receive a number card with a number from 2-10 written on it. Students will use a combination of colored pompom balls or colored BINGO stampers to show different quantities to make the number. Example: 3 red + 1 blue = 4 and 2 red + 2 blue = 4 and so on. The teacher will walk around the room to monitor combinations and ask student to explain thinking during the workshop. This activity aligns with the Common Core Standard K.OA.3; decompose numbers less than 10 into pairs in more than one way. Figure 3 shows an example of this task.

Extension: Children who have worked on numbers greater than 10 will use the corresponding colors to show combinations from 11-20. Black pompoms will be used to show the number 10. They will place the colored balls plus 10 to show combinations based on the notion of counting on from 10. If pompom balls are not available, circle stickers or BINGO markers can be used as well. Students could also use ten's stick from activity 1 plus single pompoms to show numbers higher than 10.

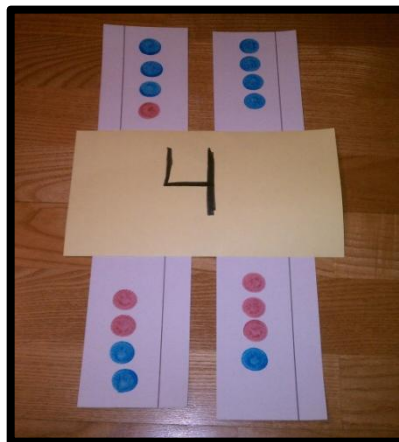


Figure 3

Number Webs

The purpose of this activity is for students to work on decomposing numbers through art while building content vocabulary as they explain their reasoning. Students will create webs of their given number to show all possible combinations or bonds. See image below. At the end of the session students will present their posters to the class. The students should compare and discuss how each poster is alike and different. This can lead to a conversation that the value 1 is always a possible combination. It could also turn to a

discussion as to what number has the greatest number of combinations and which has the least. These conversations allow the teacher to monitor understanding and assess who is grasping number bonds and who is ready for the next step in place value, double digits. This activity corresponds with the Common Core Standard K.OA.3; decompose numbers less than 10 into pairs in more than one way. Figure 4 shows an example of this task.

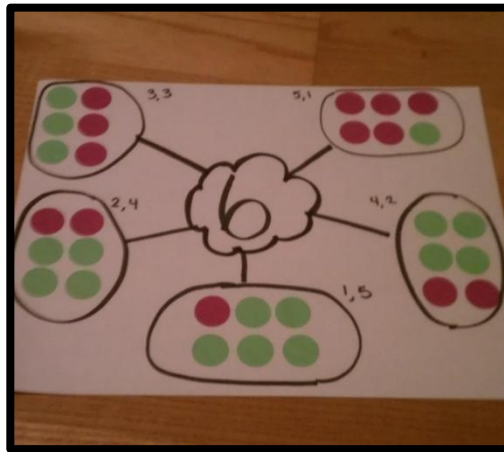


Figure 4

Cube Trains

The purpose of this activity is to practice showing the same number in a variety of ways. Students use unifix cubes to build trains of the same length or value but in different combinations. The trains are built on the recording sheet. Once built the students then color the corresponding blocks to show what they constructed. They should also write the number of cubes in the train on the line above each set. Worksheet 1 is for students to build two trains for one value and two more trains for a second value. Worksheet 2 is for four trains of all the same value. Both worksheets are included at the end of the unit. This activity is a concrete example of showing the variety of bonds possible to make the same value. These trains will be lined up one on top of each other to show the length is the same but the components are different. The trains will also be shown true to size so kinesthetic kids can line up their cubes with the patterns provided. Those students who are ready for equations can also create a number map or addition equation below the cube trains. This activity aligns with Common Core Standard K.OA.3; decompose numbers less than 10 into pairs in more than one way and the Common Core strand count to tell the number of objects. Figure 5 shows an example of this task.

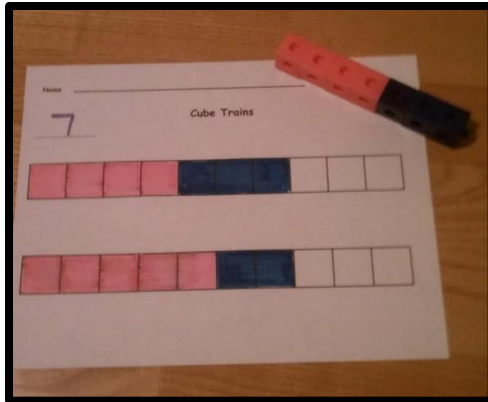


Figure 5

Number Chains:

The purpose of this activity is to practice showing the same number in a variety of ways. Students will be given a number posted on a hanger. Students will then use two different colors of paper strips that represent the variable to make chains that represent the given value. As students build the chains they will attach them to the coat hanger. For example, a coat hanger with the number four would have a chain with three blue links and one green link, a chain with two blue links and two green links, and so on. This activity is ideal for students who are visual and kinesthetic learners as it is hands on and color coded. This activity aligns with Common Core Standard K.OA.3; decompose numbers less than 10 into pairs in more than one way. Figure 6 shows an example of this task.



Figure 6

What's the Value?

The first sets of activities are modified for students who are struggling to build number bonds with a given value. The second sets of activities are modified for students who are excelling and are ready to move onto higher algebraic thinking.

Lower Level Activities:

What's in the Bag: Each bag will contain index cards with all possible number combinations for a specific value. The students must take the cards out, color the two different addends, and then decipher what the value of the card is. When they have colored all the cards they should recognize that all the combinations make the same value. Figure 7 shows an example of this task.

Missing Number Webs: Each web will have all possible number combinations filled in. The students then fill in the missing number in the middle of the web. Figure 7 shows an example of this task.

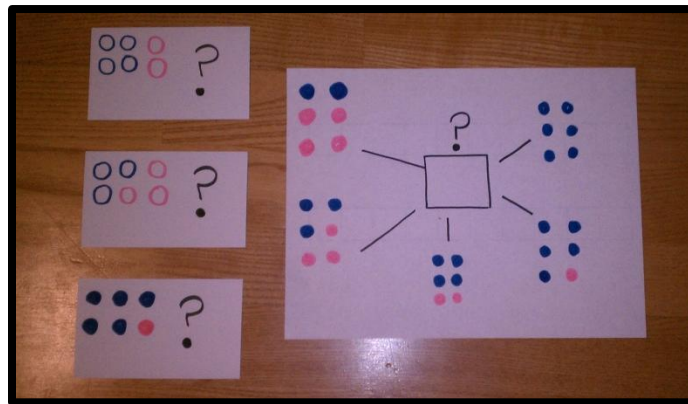


Figure 7

Extension Activities:

What's in the bag: Each bag will contain cards with a value and one part of the bond. For example a card might have 3 circles + _____ = 8 circles. The student will need to fill in the missing value on the card to make the bond true. Figure 8 shows an example of this task.

Missing Number Webs: Each web will have the value written in the middle. It will also have a line branching off that has one part of the bond missing. The student will need to complete the web's missing information to make each bond true. Figure 8 shows an example of this task.

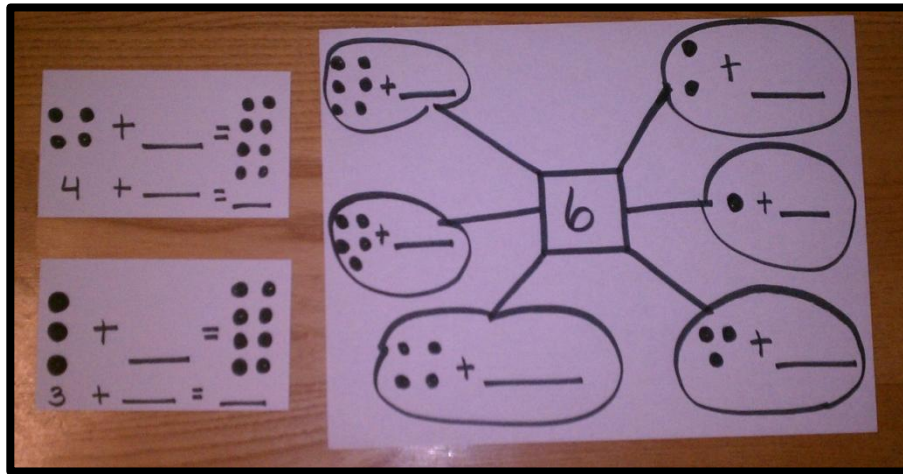


Figure 8

Today's Story:

Every few days the students will be given a real life situation to explore and solve. The problem will be read aloud to the class. Students should help the teacher highlight or underline important information and numbers. Students will then be put into small groups or partners to brainstorm solutions to the problem. Groups will be given manipulatives to encourage dramatic play and spark creativity. Chart paper should also be given to record group thinking through pictures, words, diagrams, etc. During the work time, the teacher should listen in to student conversations to assess vocabulary usage and knowledge of problem solving skills.

All students then meet together at the carpet. Groups take turns demonstrating their solution. They should also explain their answer by referring to their chart paper. Between groups the teacher should encourage others to comment on solutions. This is another opportunity to ask the following questions: How were your solutions the same or different? How many different ways can we solve this problem? Is it ok to solve this problem in different ways? When can we use this in real life?

There are two options for all situations, one for typically developing students and a challenge problem for those students who are ready for higher level algebraic thinking. For the first time, this activity should be done whole group. The teacher should choose students to act out the situation and help direct students as needed. After the dramatic play the teacher should make an anchor chart that models how to draw the solution with numbers and pictures. This anchor chart can then be referred to later when students work on problems alone.

Situation 1: Miss Arko went to the farm to buy apples. She wanted 5 apples. There are red and green apples. Show two combinations of apples she can buy.

Challenge Problem: Miss Arko went to the farm to buy apples. She wanted 5 apples. There are red, yellow, and green apples. Show four combinations of apples she can buy.

Situation 2: I am buying 2 cookies, 2 brownies, and 1 cupcake. How many items did I buy from the bakery?

Challenge Problem: How many more items do I need to buy to get to 10? What items can I buy to fill a box of ten treats?

Situation 3: 1 box of crayons holds 8 crayons. I have a purple crayon, a blue crayon, and a yellow crayon. How many colors am I missing?

Challenge Problem: 1 box of crayons holds 16 crayons. I have a purple crayon, a blue crayon, and a yellow crayon. How many crayons am I missing?

Situation 4: I am folding laundry. I should have 8 socks in all. Draw different pairs of socks to make 8 total socks.

Challenge Problem: I have 10 socks in all. Draw different pairs of socks to make 10 total socks. How many pairs do I have?

Situation 5: I am making bracelets for my friends. I made a bracelet with 10 beads. I have yellow and green beads. What are two different kinds of bracelets I could make?

Challenge Problem: I am making bracelets for my friends. I made a bracelet with 10 beads. I have yellow, blue, and green beads. What are four different kinds of bracelets I could make?

Assessment Option: Gallery Walk

Create ten posters, each with a different value 1-10. Display posters around the classroom at the eye line of students. If students have worked past 10 also hang posters with those numbers. Give each student large sticky notes or a piece of paper that correlates with the number posters. For example if you are posting the number 3 and 5, each student gets a paper with a 3 and a 5 on it. The student will walk around the room visiting each poster. At the poster they will record as many number bonds as possible on their recording sticky note and post it on the chart. Their name can be written on the back. After all students are finished review the possible bonds as a whole group. You can then use the individual papers as a way to assess who has mastered the various bonds. This activity should

probably be broken up over a few days as it is time consuming with the higher numbers. It would be best to start with two low numbers for students to practice with and for you to adjust directions as needed.

Culminating Activity: The Number Museum

After weeks of building number bonds it's time to give students the chance to show off what they know! To celebrate the end of the unit invite other classrooms and parents to visit The Number Museum your kids have constructed. The students simply display the various work products they have created around the room. Students stand near one or two of their personal artifacts as guests take a gallery walk around the room. The students will explain their pieces to the visitors as a final way to express in words the various number bonds they have mastered. For parent visitors the students can guide their special guests through the whole museum explaining number bonds and their reasoning behind each project. This can also serve as a time to assess students' knowledge of bonds and their vocabulary usage.

Resources

Bibliography for Teachers

Connect to Your Future: Celebrating Success in the Classroom. NCCAT: North Carolina Center for the Advancement of Teaching Residential Seminar for beginning teachers Spring 2010.

This was a seminar I attended in the spring of my second year of teaching. The ideas of gallery walks and culminating projects came from presentations and teaching strategies I learned on this retreat.

Fosnot, Catherine Twomey, and Maarten Ludovicus Antonius Marie Dolk. *Young Mathematicians at Work*. Portsmouth, NH: Heinemann, 2001.

This book was used to research how children best learn number sense. Most of the activities in this unit were variations or extensions from classroom ideas mentioned in this book.

Investigations in number, data, and space. 2nd ed. Glenview, Ill.: Pearson Scott Foresman, 2008.

This is the curriculum program currently being used in my classroom. I used it to reference the progression of skills for typical kindergarten students. I also used it to be sure the activities matched up with the assessments already being completed by teachers.

Chicago formatting by BibMe.org.

Reading List for Students

The following books are not necessary for the unit but can be added as supplemental material in the classroom or used during whole group modeling to integrate literacy.

Mouse Count Ellen Stole Walsh

Anno's Counting Book Mitsumasa Anno

1,2,3 to the Zoo Eric Carle

Over in the Meadow Ezra Jack Keats

The Baker's Dozen Dan Andreasen

Teeth, Tails, and Tentacles Christopher Wormell

Classroom Materials

Chart Paper

Construction Paper

BINGO stamping markers

Markers/crayons

Stickers or other small art pieces

Unifixcubes

Craft sticks

PomPom balls

Index Cards

Name _____

Cube Trains

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Name _____

