Writing in Math Starts in Kindergarten:
The Writing Journey of a Kindergartener

By Renee Hall, 2019 CTI Fellow
Mountain Island Lake Academy

This curriculum unit is intended for Kindergarten Mathematics

Keywords: explanatory writing, exploratory writing, writing in math, revoicing, repeating, reasoning, adding on, waiting, conversation norms, mathematical reasoning, question stems, answer frames, talk frames, Think-Pair-Share

Teaching Standards: See Appendix 1 for teaching standards addressed in this unit.

Synopsis: This unit focuses on the journey of a kindergartener becoming a mathematical writer. The focus will be kindergarteners explaining their thinking by sharing their ideas through talk, manipulatives, drawings, and eventually writing using the proper vocabulary. This is an opportunity to show that kindergarteners can write! Kindergarteners will be presented with a daily addition problem that they will need to solve. I will show the transitions kindergarteners make --- from expressing their thoughts through words to being able to express their thoughts through writing. The goal of this unit is to emphasize that kindergarteners can and should be encouraged to write in math. When teachers realize this process starts in kindergarten before the students can write words it will change their way of thinking and hopefully change their way of teaching to better support student learning.

I plan to teach this unit during the coming year to 18 kindergarten students.

Writing in Math Starts in Kindergarten:
The Writing Journey of a Kindergartener

By Renee Hall

Introduction

As a kindergarten teacher, it is always a challenge to infuse writing into any topic let alone mathematics. When our students begin the school year many of them cannot write their own name, so how would they be able to write in math? Often times when someone refers to writing they are referring to the paper, pen, writing words version of writing. What most people do not realize is that writing begins long before students use a pencil and paper. There are many types of writing that do not include words. The process of writing begins with thoughts, verbalization of thoughts, pictures, drawings, labels, and in most cases a discussion with peers.

In this unit I will take us through the journey that kindergartners go through in learning to write with a specific emphasis on mathematics. I will be taking a close look at how writing changes throughout the kindergarten year. Using Explanatory and Exploratory writing students will learn how to understand a simple addition problem and express their own ideas. Students will be able to share their thoughts with classmates using mathematical language. They will be introduced to the vocabulary needed to express their thoughts before they actually write anything. Responses and vocabulary will change throughout the school year as they become more comfortable with the process. Eventually these thoughts will be supported by drawings, drawings with labels, and then finally, in writing.

Once students are able to explain their mathematical thoughts informative/explanatory writing will be introduced. Students will be able to answer simple questions using given question stems. The questions will then become higher-level questions that will require students to utilize higher-level thinking skills in order to answer them and support their answer with mathematical reasoning.

School Setting:

Mountain Island Lake Academy is located in North Charlotte in the Northwest Learning Community near Mountain Island Lake. Mountain Island Lake Academy was a K-5 school until they transitioned to a K-8 school in 2013. There are 867 enrolled students consisting of 47% African American, 44% Caucasian, 5% Hispanic, and 4% Asian. The population of English Language Learners has tripled in the past two years. One half of our student population receives free or reduced lunch. This year the school was approved to become a Title 1 school. Mountain Island Lake Academy offers their scholars the Cambridge Primary Programme, an innovative and accelerated method of academic study offered through the University of Cambridge International.

I will be teaching this unit to 18 kindergarteners over the course of the year. My class includes two EL (English Learners) students and one AU (autistic) student that will need different types of support in order to be successful with this curriculum.

Rationale:

Studies report that students demonstrate greater mathematical understanding and learning through writing.[i] In this unit I want the students to be able to articulate their thoughts on solving a simple addition problem using the correct vocabulary. It is my plan to create a number of lessons aligned to the North Carolina Standards for kindergarten mathematics that will allow students to show their thinking in a variety of ways. Students will have learned and practiced conversation norms in preparation for this unit. Prior to them getting their own problems to solve there will be a lot of modeling. Modeling solving the problem will include think-alouds, using manipulatives, discussions using proper vocabulary, and eventually writing thoughts using symbols, numbers, and words. Once students have a clear understanding of expectations, students will be given an addition problem at the start of each class. They will have ample time to use manipulatives to help think through the problem. Once they feel ready they will discuss their thinking and solution with a partner using the proper vocabulary and answer stems established through conversation norms. After showing sufficient understanding, drawings will be introduced and they will be expected to show their thinking through drawings. Once drawings are introduced the students will have a math journal to put their drawings in to explain their thinking. Eventually this will lead into writing their thinking. They will always start with the problem individually, talk it through with a partner, and then draw or write their solution. I will be using a number of techniques during our talk time such as revoicing, repeating, reasoning, adding on, and waiting.[ii]

My role will be a facilitator; allowing students to take control of their own learning. The focus in this unit will be on student thinking with the teacher acting as a guide to help students explore their own thinking and coming up with their own conclusions. I will be using exploratory and explanatory writing. Exploratory writing allows students to make sense of their thoughts before they create a formal response. They are using manipulatives, talking the problem through with a peer, and writing to make sense of their own ideas. This is where they are given time to make sense of the problem, brainstorm, clarify their thinking, and ask questions to solve confusion. Explanatory writing encourages reasoning and higher-level thinking. This is where the students will make connections and see patterns utilizing specific strategies.[iii] I chose exploratory and explanatory writing to implement this unit, because that would be the natural progression for kindergarteners learning how to write in any subject. Teaching them this skill now will better prepare them for word problems in their future mathematical journeys. Kindergarteners have never had to think mathematically before, so this is something they will need to be taught through modeling and practice. Vocalizing their thoughts is a natural next step in the progression. Once they have made sense of a problem they should be able to share those thoughts with a classmate to support their thinking. Think of it like an artist, they start with a thought, an idea in their head of what they want to paint. Then they discuss it with themselves, or a colleague before they even pick up a paint brush. Writing in mathematics works much in the same way.

Unit Goals:

My goal for this unit is for the students to represent addition in different ways such as with objects, fingers, mental images, drawings, sounds, acting out situations, verbal explanations, expressions, or equations. Students will be introduced to new vocabulary, question stems, answer

frames, and talk frames. The vocabulary will be introduced through student exploration allowing them to come up with the definition on their own. Talk frames[iv] and answer frames will be modeled for the students so they know how to use them and what the expectations are. Modeling is essential in using math talk and mathematical writing, because kindergarteners have never done it before. They need to see what it looks like, sounds like, and feels like. Students will have heavy modeling in the beginning tapering off with each lesson until they are able to do it independently. Some students may require a little more scaffolding in which they will be supplied with the supports necessary for them to be successful. Data will be collected in a few different ways including checklists for observations of math talks and verbal explanations, collection of drawings, and writings.

Content Research

Colonnese states that students should be engaged in mathematical writing from kindergarten through the rest of the grades. She goes on to say that oral discourse is a key component for supporting elementary mathematical writing.[v] Students will be allowed the opportunity to reason and communicate mathematically through oral discourse starting in kindergarten. This will build a strong mathematical foundation in which they can build and become successful mathematical writers. This is the beginning of their mathematical writing journey.

Prior to any kind of math talks or interactions it is important to set up conversation norms for the students to follow. Typically these are established in the first few weeks of school and they are used in all subjects. Keep these norms simple and direct so they are easy for the students to follow.

Conversation Norms:

1. We will face each other criss cross
2. We will look at each other
3. We will lean in to show we are listening
4. We will not interrupt
5. We will talk about the question
6. We will use question stems

You would be surprised to know how many kindergarteners start school not having had conversations or proper training on how they should speak to a peer. Once norms are discussed it is important to model and allow students to practice so they know what is expected of them once math conversations begin. In order for conversations to be successful students must feel safe to share their thoughts. Spending time in the beginning on establishing norms will save you time and aggravation later. I create a Conversation Norms chart at the beginning of every year with the students to hang in the classroom as a visual reminder. It is important to include the responsibility of the listener and the speaker. Kindergarteners tend to get excited and want to talk all at once. By explaining to them the expectations of taking turns and really listening to their partner and only speaking when it is their turn will allow them the opportunity to learn from each other. Establishing these norms within the first week of school will ensure successful math conversations in the future. Allowing them to practice with easier discussion topics will allow them to strengthen their conversation skills. For example, ask them questions like:

1. What is your favorite subject in school? Why?
2. What is your favorite special area? Why?
3. Based on the title and cover what do you think this book is going to be about? Why do you think that?
4. Why is math important?
5. What do you think about when you think of math? (create an anchor chart)

Questions such as these will build their confidence and comfort in sharing their ideas.

Students learn in three ways: processing information, hearing ideas from others, and connecting new thinking to prior knowledge[vi] When you hear someone say that kids learn best from other kids there is a lot of truth to that. In order for children to learn, understand, and remember, they need experiences to interact with the idea, think about it in relation to what they already know, uncover its logic, and then apply their thinking to the new idea.

Chapin, O'Connor, and Anderson state that there are five productive talk moves: *Revoicing, Repeating, Reasoning, Adding On,* and *Waiting.* They have found those five moves to be effective with mathematical thinking and learning. *Revoicing* is simply restating what the student said into a question and asking if you said it correctly. *Repeating* is when you ask a student to repeat what his partner just said in his own words. *Reasoning* is asking students to agree or disagree and give a valid reason why, defend their argument. *Adding on* is asking students to add on new information to the previous students answer. *Waiting* is probably one of the most important ones, because you need to allow students time to come up with their response.[vii] You will always have those students that raise their hand immediately, but it is important to allow those students that take a bit longer to process the question to have ample time to come up with their own solution. Failing to do this will create an environment of students not trying, because someone else will do the thinking for them. I plan to use all five talk moves at different points in my lessons. I will probably use the *waiting* move the most because every individual processes information differently and I want to allow my students ample time to think so they can contribute to the discussion and feel that what they have to say is just as important. I also like to use *adding on* which gives all the students a chance to elaborate on their thinking. This gives other students an opportunity to add in their thoughts and possibly show a different way of thinking about the question. *Revoicing* can be useful when some student's responses are not exactly clear or hard to understand. This helps bring clarity to what they are saying for the rest of the students. *Repeating* allows all students the opportunity to contribute and increases the likelihood that the rest of the students understand what is being said. I may use *reasoning* in a few instances where I feel that the students can handle agreeing or disagreeing with classmates using the correct terminology. This a harder skill for kindergartners to master so it may be reserved for my more advanced students.

Chapin, O'Connor, and Anderson also explain that the three talk formats: whole class discussion, small group discussion, and partner talk all have their own strengths and weaknesses.[viii] Of course the rules for each format vary slightly and should be established prior to getting into more serious math conversations. Whole class discussion allows students to practice mathematical reasoning without worrying about the correct answer. The teacher acts as a facilitator guiding the students to share their thinking. Discussions like these will allow the teacher to hear and address misunderstandings. It is not always beneficial to allow students to go

on thinking that misinformation is correct, however the purpose of this format is to get the students talking comfortably and not necessarily worry about the correct answer. The downside is that in many cases you have the same four or five students raising their hand to answer. Small group discussions are typically initiated with a question posed by the teacher, but discussed in small groups where the teacher acts as an observer and listens in on conversations. The teacher may choose to ask more questions or make a statement to guide students with their thinking. The downside is that you cannot ensure that all groups are on task and discussing the question, nor can you control if one or two of the students in each group are controlling the discussion. Partner talk is also initiated with a question from the teacher and in most cases using the Think-Pair-Share Model students discuss their ideas. The Think-Pair-Share Model goes like this:

1. Teacher poses a question.
2. Students are given time to think.
3. Students are paired (peanut butter and jelly partners)
4. Students turn and discuss their thoughts with their partner.

Peanut butter and jelly partners are simply predetermined partners selected by the teacher. I suggest predetermined partners so that the teacher can be strategic in placing students with partners that will mathematically encourage each other and not one partner that is doing all the thinking. Partner talk allows all students to have a voice when they follow the conversation norms set in place since the first day. Then the teacher can open it back up to the whole class and those students that may have been scared to share have had a chance to talk through their thoughts and may be more apt to share whole class. It is important that the teacher carefully selects the best format to use to be most successful in the talk she plans to have with her students. For instance, if the teacher just wants to get a feel for what students already know about a topic or she just wants to get them thinking then a whole group discussion might be a good way to get started. If the teacher wants to see if students are starting to understand a topic or she has an activity that she wants them to do and discuss a small group discussion would be appropriate. However, if a teacher wants to assess understanding of what she has taught, vocabulary, or a specific skill it is probably easier to see during partner talk. During these conversations is when the teacher collects most of her data on whether or not the students are understanding the math concepts she is teaching. I will be utilizing all three types of talk formats at different times throughout the unit. Whole class discussion and partner talk will take place during the lesson and small group talk will take place when I pull students based on their individual needs. Whole class discussion is an important component because it reveals confusion, misconceptions, and partial understandings. Small group discussions will be observed but I will only be posing the question. The students will be controlling the discussion. Partner talk will also be utilized during my lessons where I will pose a question and we will use the Think-Pair-Share model. The students have a few minutes to think about the problem, they share with a partner using the conversation norms established, and then they share with the class. I will be taking anecdotal notes during these times and utilizing a checklist that will get more detailed as time goes on.

The expectations for discussions will change as the students become more familiar with the vocabulary and the addition process. I will not expect them to use terminology that has not yet been taught in the beginning of the unit, but the expectation will be that the students will start utilizing vocabulary and mathematical terms as they learn them. Herbel-Eisenmann states that teachers need to guide students into using mathematical language.[ix] In order to accomplish this, students must first be able to explain their thoughts in their own words. They should be

given the opportunity to struggle a little and come up with their own terminology before sharing mathematical terminology with them. This method will be used at the beginning of the unit prior to students learning the vocabulary needed to have a mathematical discussion. This is a time for note taking and listening in on discussions so that I can better understand their way of thinking. After a lot of modeling and students have had a chance to express their thoughts in their own words they will be introduced to the vocabulary. It will be interesting to see how this changes their conversations with peers.

Teguh conducted a study with 68 students that determined the importance of modeling on student learning. The study showed that there was a positive effect on learning outcomes when modeling was utilized[x].Modeling is a large part of teaching in kindergarten. The students have no prior knowledge of the topics being taught. They do not know what is expected of them unless the teacher shows them. Modeling for the students will alleviate any stress they may have about not doing it right and give them confidence that they can be successful. This also allows the teacher to assess whether or not the students understand the strategy not the way to implement it.

Instructional Implementation

In order to address the unit objectives students will utilize objects such as connecting cubes and bear counters, fingers, mental images, drawings, sounds, acting out situations, verbal explanations, or equations to add numbers up to ten. Students will start the process of writing in mathematics with oral discourse and by the end of the unit they will be writing using labels, equations, and drawings to explain their thinking.

Teaching Strategies:

Direct Instruction**:** Explicit teaching of skills needed to solve problems. This will be used primarily for the opening question of the day.

Modeling**:** The teacher will show students exactly what is expected for oral and written discourse.

Small Group Instruction: Teacher will pose a question and allow students to control the conversation in coming to a solution.

Partner Work: Students will work with partners solving and explaining their thinking using proper vocabulary.

<u>Talk Formats:</u>

Partner Talk: Pairs of students discuss a question that the teacher has posed.

Small Group Talk: Small groups of students discuss a question the teacher has posed.

Whole Class Talk: All of the students think about the question the teacher has posed and the teacher selects a few to share their thinking.

Gallery Walks: Students will walk around the room and see each other's work.

Think-Pair-Share: Strategy used to allow students to think before they share with their partner.

Turn and Talk: Students talk with the person sitting next to them.

Conversation Norms: Rules for conversation will be established prior to the start of the unit.

We will face each other criss-cross

We will look at each other

We will lean in to show we are listening

We will not interrupt

We will talk about the question

We will use question stems

Rules:

1. We will listen to our partner
2. We will take turns
3. We will be kind
4. We will share

Vocabulary Word Wall: Students will have a vocabulary word wall with words specific to this unit to reference for new vocabulary words pertaining to the topic.

Addition

Sum

Equal to

Addends

join

in all

Part

Whole

equation

plus

Answer Frames: Students will be given an answer frame in which to use when responding to peers. Some examples of these are:

“I believe____”

“I think____”

“_____ because”----------

Response Frames for Discussions:

“I agree because_____”

“I disagree because_____”

“Explain that more”

“Repeat that please”

“I don’t understand ____”

Question Frames for Discussions: Students will be given question frames in order to ask peers to explain their thinking.

“Why do you think that?”

“Can you tell me more about___?”

Manipulatives: Students will be given manipulatives to help them solve the problem and explain their thinking.

Counting Bears

Two-colored counters

Snap Cubes

Ten frames

Math Journal: Students will use a math journal for their drawings and writing. The math journal is lined pages (to help with writing numbers) with a space at the top for drawing out the problems.

Classroom Lessons/Activities

Lesson 1

Give students 5 cubes (3 blue and 2 red). Ask the students to count the red cubes and then count the blue cubes. Pose the questions: How many cubes do you have in all? How can you find out?

Allow students *waiting time* to work it out and think about the questions.

Using turn and talk have students share their findings with their elbow partner.

Whole class discussion: How many cubes do you have in all? Did anyone get a different answer? How do you know you are right? Show me with your fingers (for struggling students only). You will need to model this. Draw a picture of how you solved the problem and write the two numbers in your journals. (This is a good time to use *repeating, revoicing, and adding on* as warranted. It is going to depend on the responses you get from the students.)

Explain to the students that when you take two numbers and put them together it is called addition. "You say it like this: three plus two equals five."

Have students repeat this with 4 blue cubes and 1 red cubes. Pose the same two questions: How many cubes do you have in all? How can you find out? Show with your fingers. Draw a picture of how you solved the problem and write the two numbers in your journals.

Allow students *waiting time* to work it out and think about the questions.

Using turn and talk have students share their findings with their elbow partner.

Whole class discussion: Did anyone get a different answer? How do you know you are right?

Use *repeating* to have a few students say it in their own words.

Have students repeat this with 3 blue cubes and 3 red cubes. Pose the same two questions: How many cubes do you have in all? How can you find out? Show with your fingers. Draw a picture of how you solved the problem and write the two numbers in your journals.

Allow students *waiting time* to work it out and think about the questions.

Using turn and talk have students share their findings with their elbow partner.

Whole class discussion: Did anyone get a different answer? How do you know you are right?

Use *repeating* to have a few students say it in their own words.

Now allow students to pair up and create their own problems. Each partner is to choose up to five cubes of the same color and when they put them together they need to determine how many they have in all. They will use the same format as above. Drawing a picture of their thinking in their journals. Students will trace the cubes that they counted and label with numbers. This will allow the teacher to assess their thinking.

*For scaffolding: Students needing extra support can be given ten frames. Students needing more of a challenge can be given two ten frames so they can expand into double digit numbers or encouraged to choose up to twenty cubes.

Exit Ticket: Have students count out 4 blue cubes and 3 red cubes. Have them draw a picture of the cubes in their math journals and label them with numbers. Draw a big circle around both and

write how many in all on the outside of the circle. Model another problem similar to this one so they know exactly what they are supposed to do.

Lesson 2

Briefly discuss what you did yesterday.

On chart paper write the following poem:

4 little starfish were swimming in the sea,

2 were added to them saying, “Look at me!”

“Look at me,” they said again.

How many starfish were there then?[xi]

Read the poem twice. The first time the students just listen and the second time have students show how many starfish there are using counters. Pose these two questions: How many starfish are swimming in the sea? How do you know?

Turn and talk using this answer frame: I know there are _____ starfish because _____.

Have students draw a picture in their math journals showing how they know and labeling with numbers.

Repeat this process two or three more times using different numbers.

Students will then play the game Ten Frame Addition using ten frames and two different color counters. Each pair of students is given a ten frame and number cards 0-5 (4 of each number) or dice 0-5. Player 1 flips a card or rolls the die and places that many counters on the ten frame. Player 2 flips a cad or rolls a die and places that many counters of the other color on the same ten frame. They count the total number of counters together. They will record the numbers in their math journals. They will discuss these two questions: How many counters in all? How do you know? They will use the answer frame: I know there are ____ counters because _____.

The first player rolled a _____. After they have done that a few times switch it up by having them stop after the first person rolls and determine what the second person would need to roll in order to get ten. Answer Frame: _____rolled a _____, so _____needs to roll a _____ in order to have ten.

Exit Ticket:

Give each student a ten frame and counters. Give them this problem: Two students are playing Ten Frame Addition. The first student rolled a 2 and the second rolled a 4. How many counters do they have on all? How do you know?

*Scaffolding: For students who need more of a challenge, give them two ten frames.

Lesson 3 Appendix 2

Give the students counters and project the 2 ponds.

Sarah sees two ponds. One has 3 fish swimming in it. The other pond has 2 fish swimming it. Use counters to show how many fish are swimming in each pond. Write the number of fish in your journals. How many fish are swimming in all? Write the number and use counters to show how you know.

Students will compare their answers with the students at their table and have a discussion. They can use these answer stems:

If they come up with different answers:

I disagree because_____

How can you figure out who is correct?

If they come up with the same answer:

I agree because_____

How do you know you are both right?

This allows them to restate the problem in their own words.

Give every student a piece of construction paper and set of counting bears (2 colors).

Students will be paired with their peanut butter and jelly partners. Each partner chooses a group of bears and places them on either side of the construction paper. Pose the question: How many are in each group? Write these numbers in your journals.

Put all your bears on the construction paper. How many bears are there in all? Use the sentence frame: _____ and _____ is _____.

Repeat this a couple of times.

Exit Ticket:

Show students a picture of 4 boys and 5 girls on different sides of a playground. Ask them if all students went on the playground together how many students would be on the playground? Write both numbers on your white boards. Using the sentence frame: _____ and _____ is _____. Fill in the blanks with the correct numbers and show or explain how you know with a drawing and words.

*Scaffolding: Students who need more support can use ten frames and manipulatives. Students who need a more challenging problem could use larger numbers or introduce the plus and equals sign.

Lesson 4 Appendix 3

Start off with a problem:

Sara sees 6 butterflies and then she sees 2 more butterflies. What numbers do you add to find out how many butterflies Sara sees in all? How can you show the adding? Draw a picture in your math journals.

Have students share their drawings with their table mates. Explain your drawings using these sentence stems: I drew _____ butterflies and _____ butterflies because_____. This means that there are _____butterflies in all. This is how I showed the adding.

Whole class discussion: Let students share what they drew and how they solved the problem in their table groups. Ask for volunteers to share what they discussed at their tables. After the first student responds they will choose another student to add on or challenge what they said. That student will then choose another student to do the same. Repeat this so that several students have a chance to share in their own words.

Introduce the plus sign and equal sign to the students by explaining what an equation is and showing them how you write one.

Play Addition Memory Match: Pair the students up and have them play memory match with the cards matching the equation to the picture card.

Have students practice drawing pictures and writing addition equations in their math journals with this activity:

Create eight paper bags with 2 colors of cubes up to ten (for example: one bag might have 6 blue cubes and 3 red cubes, another bag might have 7 blue cubes and 1 red cube). Students will work with their peanut butter and jelly partners. Each set of partners will get a bag and a laminated template that looks like this _____ □____ □_____. They will take turns pulling out the cubes and sorting them by color. Once they are sorted they will need to count them and complete the equation. This will give them practice writing the plus sign and equals sign. Model this with a student volunteer before letting the students attempt it.

Students will swap bags with other partners to give them several chances to write an addition equation.

Exit Ticket:

Show students picture of bears. How many bears in all? Have them come up with a drawing and an addition equation to show how they know.

Lesson 5 Appendix 4

Show the students the picture of the flower and bees and read the following problem: There are 4 bees collecting pollen from a flower. 3 more bees join them. How many bees are collecting pollen now? Show how you know in two ways and explain how you know.

Supply manipulatives as needed.

Turn and talk: Allow students time to explain their thinking to their elbow partner.

Whole class discussion. Ask for volunteers to come up and explain it to the class.

Use *repeating, revoicing* (if applicable), and *adding on* as students volunteer. This will give all students an opportunity to participate.

Have students listen to the following stories, use counters, draw a picture in their journals, and then write an equation.

Four girls get ice cream. Four boys join them. How many children are getting ice cream in all?

Three boys play ball. Five girls join them. How many children are playing ball in all?

Give students ample *waiting time* to think about the problem. Have them discuss with a partner.

Ask for volunteers to come to the board and share their ideas. Use *repeating, revoicing* (if applicable), and *adding on* as students volunteer. This will give all students an opportunity to participate.

Exit Ticket:

Have students listen to the following story, use counters, draw a picture in their journals, and then write an equation.

There are six kittens playing. Three kittens join them. Jack thinks there are 9 kittens in all and Sam thinks there are 6 kittens in all. Who do you agree with and why?

*Scaffolding: Students who need extra support can be given an equation frame. Students who need to be challenged could be given a question like this:

Six kittens are playing. Some more kittens join them. There are nine kittens playing in all. How many more came to play?

Lesson 6 Appendix 4

Have students listen to the following story:
Jacob's mother is making birthday treats. She makes two treats for boys and four treats for girls. Now she has six treats. How does Jacob's mother know that she has made six treats? Explain and then show how you know.

Give students ample *waiting time* to think through the problem.
Have students share their solutions at their tables.

Whole class discussion: Ask for volunteers to explain their answer and how they know they are correct. Ask: Did anyone figure it out in a different way? Use *repeating, revoicing* (if applicable), and *adding on* as students volunteer. This will give all students an opportunity to participate.

Have students listen to the following stories and have them solve them with pictures and equations.

Give students ample *waiting time* to think through the problem.

1. David has 5 apples in a fruit basket and 3 apples on the table. How many apples does David have in all?

2. Brian eats 2 crackers at lunch and 7 crackers at snack. How many crackers did Brian eat in all?

3. There are 4 boys and 2 girls on the bus. How many children are on the bus in all?

4. Show students two possible answers and have them choose the correct one after listening to the story. Explain why the other set is not the correct answer:

5. Brandon picks 5 blueberries. Then he picks 3 more blueberries. How many blueberries did he pick in all?

Have students share their solutions at their tables.

Exit Ticket:

Tell students the following story:

Brenda has seven marbles and finds three more marbles Brenda has ten marbles in all. How does Brenda know that she has ten marbles? Explain and then show how you know.
Give students ample *waiting time* to think through the problem.

Have students share their thoughts with a partner and draw a picture or an equation.

Lesson 7

Give students blue and red cubes. Tell them: Make stacks of 5 cubes. How many different ways can you make a stack of 5 cubes?

Draw pictures and write equations in your journals to describe your stacks. How many blue cubes? How many red cubes? (use crayons)

Have students share their different ways to make three with a partner.

Whole class discussion: Have students come up and show the different ways they made five with the cubes and then draw their ways in the board. Use *repeating, revoicing* (if applicable), and *adding on* as students volunteer. This will give all students an opportunity to participate.

Repeat this problem and procedure with the numbers five and seven.

Give pairs of students number cards from 2 to 10. Students will take turns choosing a card and coming up with all the combinations they can with cubes, drawings, and labels.

Ask students if they can come up with addition equations to show these different combinations.

Whole class discussion: How are the pictures they drew, the cube towers they made, and the equations that wrote connected? Use *repeating, revoicing* (if applicable), and *adding on* as students volunteer. This will give all students an opportunity to participate.

Exit Ticket:

Give students the number seen and have them come up with a cube combination, drawing, and an equation to represent that number.

Lesson 8

Tell students the following story:

Give students two pieces of construction paper and some cubes.

Mrs. Hall has eight pieces of fruit and two plates (red and blue). How many different ways can she separate the pieces of fruit onto her plates?

Give students ample *waiting time* to think about the problem and come up with some solutions,

Whole class discussion: What are some of the different ways we can show how she separated the fruit? Ask for volunteers to come up and show some different ways. What could we draw to show how she separated the fruit? Have volunteers come up and draw pictures or share theirs. Can we show this in an equation? Have volunteers give different equations. Use *repeating, revoicing* (if applicable), and *adding on* as students volunteer. This will give all students an opportunity to participate.

Give each pair of students a die. The goal is to figure out how what number you need to roll next to have it equal ten. Have them take turns rolling the die. Then they need to tell what number they would need to roll next to equal ten if they were adding. (For example: They rolled a four. They would need to roll a six next to get ten). They need to explain their thinking to their partner and tell them how they know that is how many more they need.

Exit Ticket:

What is one equation that I can write for the number six?

*Scaffolding: Students who need additional support can use manipulatives and a ten frame. Students who need more of a challenge can be given higher numbers.

Assessment

The end of topic assessment will be given one on one. The following questions will he asked of each student. They will have manipulatives and ten frames if they choose to use them. The teacher will make anecdotal notes as well as document whether or not they got the answer correct.

1. Katy has two pieces of blue bubble gum and three pieces of red bubble gum. How many pieces of bubble gum does Katy have in all? Draw a picture to show how you know.

2. Six tadpoles were swimming in the pond. Two more tadpoles joined them. How many tadpoles are swimming in the pond now? Draw a picture to show how you know.

3. Sam has seven flowers. What are two ways that he can separate his flowers into his blue vase and red vase? Draw a picture to show the ways.

4. Sally is missing five buttons on her jacket. How many ways can you use blue and red buttons to finish her jacket? Draw a picture to show the ways.

5. Francis has four pieces of candy. How many more pieces of candy does he need to have ten pieces of candy? Draw a picture to show your thinking.

6. A box of chocolates has ten pieces of chocolate. There are only five pieces of chocolate in this box. How many chocolates are missing? Draw a picture to show your thinking.

7. There are four birds on a tree. Three more birds fly in. How many birds are on the tree now? Use a drawing and an equation to show your thinking.

8. Show the student one red cube and six blue cubes. How many red cubes are there? How many blue cubes are there? How many cubes are there in all? Write an equation to show how you know.

9. Drop eight (two-sided) chips. Write an equation to show how many chips there are all together.

10. Use a ten frame and two sided chips to show the addition problem: 4+6=10. Explain how you know this is correct.

Appendix I: Implementing Teaching Standards for North Carolina Standard Course of Study

NC.K.OA.1 Represent addition and subtraction, within 10:

• Use a variety of representations such as objects, fingers, mental images, drawings, sounds, acting out situations, verbal explanations, or expressions.

• Demonstrate understanding of addition and subtraction by making connections among representations

Clarifying Objective:

In this standard, students demonstrate an understanding of how objects can be put together (composed) and taken apart (decompose) by modeling addition and subtraction of up to 10 objects in various ways.

NC.K.OA.2 Solve addition and subtraction word problems, within 10, using objects or drawings to represent the problem, when solving:

• Add to/Take From-Result Unknown

• Put Together/ Take Apart (Total Unknown and Two Addends Unknown)

Clarifying Objective:

In this standard, students apply their work from NC.K.OA.1 to solve addition and subtraction problems involving a variety of situations.

NC.K.OA.3 Decompose numbers less than or equal to 10 into pairs in more than one way using objects or drawings, and record each decomposition by a drawing or expression.

Clarifying Objective:

In this standard, students develop an understanding of part-whole relationships as they recognize that a given group of objects (up to 10) can be decomposed into sub-groups while remaining equivalent to the total amount. For example, a set of 6 cubes can be separated into a set of 2 cubes and a set of 4 cubes while remaining 6 total cubes. Additionally, this standard asks students to recognize that a group can be decomposed (broken apart) in multiple ways.

NC.K.OA.4 For any number from 0 to 10, find the number that makes 10 when added to the given number using objects or drawings, and record the answer with a drawing or expression.

Clarifying Objective:

This standard builds on the work of NC.K.OA.3, where students developed an understanding that a number less than or equal to 10, can be decomposed into parts.

NC.K.OA.5 Demonstrate fluency with addition and subtraction within 5.

Clarifying Objective:

This standard calls for students to show they are fluent in addition and subtraction. Students are fluent when they display accuracy (correct answer), efficiency (a reasonable amount of steps in about 3-5 seconds without resorting to counting), and flexibility (using strategies such as the distributive property).

NC.K.OA.6 Recognize and combine groups with totals up to 5 (conceptual subitizing).

Clarifying Objective:

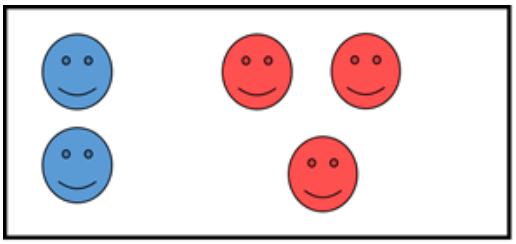
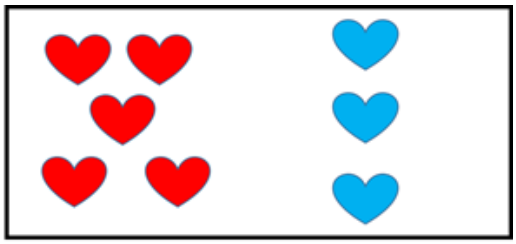
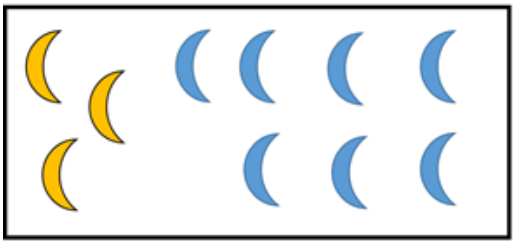
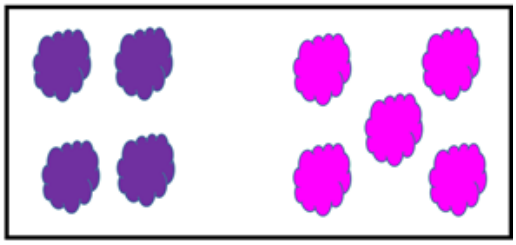
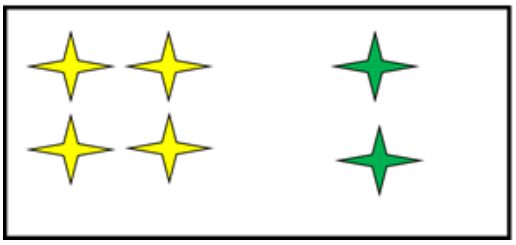
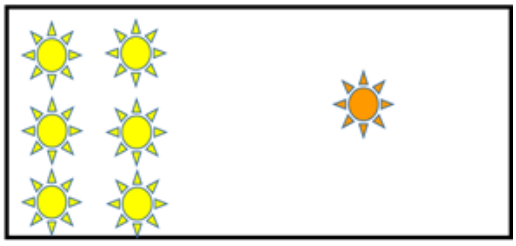
This standard calls for students to conceptually subitize a group of objects (up to 5). Conceptual subitizing involves recognizing a number pattern as a group composed of subgroups. Students visually see subgroups of quantities within a larger quantity and learn that the subgroups can be combined to compose a whole.

*All clipart and problems were created by Renee Hall.

Appendix 2:

Pond A

Pond B

$2 + 3 = 5$	$5 + 3 = 8$
$3 + 7 = 10$	$4 + 5 = 9$
$4 + 2 = 6$	$6 + 1 = 7$
	
	
	

Appendix 3

Appendix 4

Answer A:

Answer B:

List of Materials

Connecting Cubes

Ten Frames

Counting Bears

Math journals

Conversation norms anchor chart

Vocabulary word wall

Response frames/answer frames/question frames anchor charts

Two-colored counters

Students Resources

Dreambox

This is an adaptive learning platform that makes it fun for the students to practice what they have learned in class.

Edgenuity

This is a learning platform that the teacher can assign specific skills practice to the students based on their needs.

Envisions

This is the math program that our school utilizes. Students have access to video links and games to help them understand the skills that are being taught in the classroom.

Teacher Resources

Unpacking Guide

This helps teachers plan for lessons and keeps them on schedule to ensure all skills are taught throughout the school year. This shows teachers what students are expected to be able to do.

Envision

There are video clips to help teachers understand why and how they are teaching skills.

Investigation

This resource supplies teachers with great activities and games to support student learning.

Bibliography

Bossé, Michael J., and Johna Faulconer. "Learning and assessing mathematics through reading and writing." *School Science and Mathematics* 108, no. 1 (2008): 8-19.

Casa, T. M., J. M. Firmender, J. Cahill, F. Cardetti, J. M. Choppin, J. Cohen, and R. Zawodniak. "Types of and purposes for elementary mathematical writing: Task force recommendations." (2016).

Chapin, Suzanne H., Catherine O'Connor, Mary Catherine O'Connor, and Nancy Canavan Anderson. *Classroom discussions: Using math talk to help students learn, Grades K-6*. Math Solutions, 2009.

Colonnese, M. W. (2017). Developing instructional guidelines for elementary mathematical writing (Doctoral dissertation). Retrieved from http://opencommons.uconn.edu/dissertations/1503

Firmender, Janine M., Tutita M. Casa, and Madelynn W. Colonnese. "Write on." *Teaching Children Mathematics* 24, no. 2 (2017): 84-92.

Foresman, Scott, and Addison Wesley. "enVisionMATH™." (2008).

Gjems, Liv. "Teaching in ECE: Promoting children's language learning and cooperation on knowledge construction in everyday conversations in kindergarten." *Teaching and teacher education* 29 (2013): 39-45.

Herbel-Eisenmann, Beth A. "Using student contributions and multiple representations to develop mathematical language." *Mathematics Teaching in the Middle School* 8, no. 2 (2002): 100.

Otten, S. J., B. Herbel-Eisenmann, M. D. Steele, Michelle Cirillo, and Heather M. Bosman. "Students actively listening: A foundation for productive discourse in mathematics classrooms." In *Annual Meeting of the American Educational Research Association, New Orleans, LA*. 2011.

Schielack, Dr Jane. "Developing Mathematical Thinking Habits Through Mathematical Practices: Kindergarten Through Grade 5."

Teguh Prasetyo. “Implementation of Mathematical Modeling in Elementary School.” *Edukasi: Jurnal Penelitian dan Artikel Pendidikan* 9, no. 1 (September 1, 2017): 32–42.

Williams, Madelyn M., and Tutita M. Casa. "Connecting class talk with individual student writing." *Teaching Children's Mathematics* 18, no. 5 (2012): 314-321.

Notes

---

[i] Bossé, Michael J., and Johna Faulconer. "Learning and assessing mathematics through reading and writing." *School Science and Mathematics* 108, no. 1 (2008): 8-19.
[ii] Chapin, Suzanne H., Catherine O'Connor, Mary Catherine O'Connor, and Nancy Canavan Anderson. *Classroom discussions: Using math talk to help students learn, Grades K-6*. Math Solutions, 2009.
[iii] Casa, T. M., J. M. Firmender, J. Cahill, F. Cardetti, J. M. Choppin, J. Cohen, and R. Zawodniak. "Types of and purposes for elementary mathematical writing: Task force recommendations." (2016).
[iv] Ibid
[v] Ibid
[vi] Colonnese, M. W. (2017). Developing instructional guidelines for elementary mathematical writing (Doctoral dissertation). Retrieved from http://opencommons.uconn.edu/dissertations/1503
[vii] Chapin, Suzanne H., Catherine O'Connor, Mary Catherine O'Connor, and Nancy Canavan Anderson. *Classroom discussions: Using math talk to help students learn, Grades K-6*. Math Solutions, 2009.
[viii] Ibid
[ix] Ibid
[x] Teguh Prasetyo. "Implementation of Mathematical Modeling in Elementary School." *Edukasi: Jurnal Penelitian dan Artikel Pendidikan* 9, no. 1 (September 1, 2017): 32–42.
[xi] Foresman, Scott, and Addison Wesley. "enVisionMATH™." (2008).