**Objective:**

Students will estimate the number of possibilities that can come out given different situations.

Students will actually determine exactly the number of possibilities possible by various activities.

Students will create tree diagrams to display data.

**PASS Objectives:**

Grade 2:

- **Standard 5:**
  1. Collect, Sort, Organize, and display data in charts, bar graphs, and tables.
  2. Summarize and interpret data in charts, bar graphs, and tables.
  3. Make predictions and estimates to describe data.

Grade 3: (I list these because this lesson can be adapted easily to meet the PASS for 3rd Grade)

- **Standard 5:**
  1. **Data Analysis**
     a. Pose questions, collect, record, and interpret data to help answer questions.
     b. Read graphs and charts; identify the main idea, draw conclusions, make predictions based on the data.
     c. Construct a bar graph or pictograph with labels and a title from a set of data.
  2. **Probability**
     a. Describe the Probability of Chance Events
     b. List arrangements (permutations—where order of options matters) and combinations (where order does not matter) of up to three items.

**Resources:**

This lesson was adapted from a unit on NCTM about combinations and permutations for grades 4-6 all reproducible can be found on the following link: [http://illuminations.nctm.org/LessonDetail.aspx?ID=U75](http://illuminations.nctm.org/LessonDetail.aspx?ID=U75)
Instruction:

Introduction:

Before beginning the lesson, the students will complete the following prompt in their “Math Journal”. What is a combination? Then they will be given the Pre-Test. Then the introduction of the lesson will be done with a Smart Board. Also throughout the introductory presentation of the concept we will discuss that combinations are not concerned with the order of options, but I will mention the word permutations since they will be going into that in 3rd grade.

Instructional Process:

Activity 1: After the introduction of the lesson we will work on our first practice activity which will be a clothing combination that the students will complete on the SMARTBOARD. This interactive activity is found at http://illuminations.nctm.org/ActivityDetail.aspx?ID=3. This activity would be considered a visual and tactile Learning activity. The students will estimate the number of combinations that are possible for the activity. Then they will complete the activity and actually arrive at an exact number of possible combinations. Finally, they will verbally summarize the combination possibilities.

Activity 2: After all students have attempted and completed the Bobbie Bear Activity we will begin Activity 2. To begin this activity, have the students brainstorm about other situations in real life in which we use combinations. Then we will discuss that restaurants use combinations all the time. We will then discuss the use of multiplying (multiplying the options to get total outcome possibilities) and the use of tree diagrams (to arrive at the different combinations possible) in working with combinations. At this time they will begin by estimating the number of possible combinations of purchasing two items in the Lobo Café with one item being a main dish and the other a dessert. Write the students estimations on the Board. Together as a class we will complete a tree diagram for a menu, in the case of this lesson, it is the menu of the “Lobo Café”. When the tree diagram is complete have the students check their estimations for accuracy. Discuss how close they were and what they can do later to arrive at the correct number of possibilities accurately based on what we discussed after they estimated the outcomes.

Activity 3: The third and final activity of the lesson will be the following: Pizza Creation using a tree diagram to calculate number of outcomes and describe the different combinations. First we will review the term “combination” Then we will also discuss multiplying options as well as the tree diagram. Then students will then estimate how many combinations of personal pizzas we could make with the given ingredients. In this case, I used (meats=ground beef or pepperoni vegetables=onion, bell pepper, and tomatoes). Students will then form a tree diagram using pictures of the ingredients. For the outcome they will simply place a sticky note with the combination written on it. When we have arrived at our final number of combinations each student will create one of the combination pizzas with the ingredients. We will take pictures of each of the final outcomes and place them on the bottom of the charts.

Closure:

The closure of the lesson will be the discussion and review of the terms combination, outcomes, predictions, as well as estimation. We will also discuss once more the use of multiplying the find the number of combinations and the use of the tree diagram as a visual way of arriving at the different combinations. At this time we will complete the post-test. After their post-test they will complete the final part of their “Math Journal” which consists of them listing two things they learned in this lesson.
**Assessment:** The overall lesson assessment will be done through the pre and post-test. Activity One is assessed through the visual observation of completion of Bobbie Bear activity. Activity Two is assessed informally through their participation as we as a class complete the tree diagram on the “Lobo Café”. Activity Three is assessed informally through observation of participation as well as understanding of the concepts presented. The final assessment of Activity three is derived from the correct completion of the tree diagram.

**Modifications/Accommodations:**

**Visual Modification:** I have a student that has many visual problems. We are not sure how much the student can or cannot see. I always make sure to have as much of what I say also visible for the students see again and again if they need it. Having a SmartBoard really facilitates this issue. Along with the visuals, I always make sure the student understands what I have asked because this student may still be trying to decipher what is on the board. I always repeat the synthesized directions to the student once more and check the students’ progress continually throughout the lesson. I also try to make the font a large size on SmartBoard presentations, handouts, etc. to avoid unnecessary strain on the eyes.

**ELL Modification:** We recently received a student about 4 weeks ago that knows very little or no English. While this situation has been challenging it has also been a little easier for me since the student’s native language is Spanish. I just repeat most things for the student in Spanish. Again, having the visuals are also very helpful for students that do not understand English yet. Even though they cannot follow most of what you are saying, they may be able to follow the lesson more through the visuals. I always have this student participate during the lessons and when the students participate on the board I usually have this student go up last, because by then through visual observation the student has most of the time grasped what we are doing on the SmartBoard.

**Slow Learner:** If this lesson becomes frustrating to your slow learner you may want to cut down on the number of options on the activities. Activity Two could be reduced to hamburger, hot dog, and ice cream cone. The last activity may require step-by-step guidance, but you could also pair this student with another person which you think may work well with this student to complete a group project.

**Gifted Students:** This lesson can be made more challenging by increasing the items in the scenarios to create larger and more complex combinations. You may also be able to get into permutations with this group.

**Lesson Extension:** After we made the possible pizzas, I allowed the student to make the pizza with the toppings of their choice. A possible extension of this lesson could be to create some sort of graph to display the students’ topping choices. This could be done through a bar graph, circle graph, etc.

**Reflection**

A. How did the lesson go? Any changes you might make next time due to time constraints, student participation, materials used, etc.? Did the students enjoy the lesson? Did everything work as you had anticipated? Do you feel good about the lesson?
The lesson went well over all. It took way longer than I had planned. This lesson is totally a unit in and of itself. I will definitely plan to do this in a two week time period. I would not leave out any activity for time constraints because the practice is very necessary. I cut out most of the pieces they needed for their post-test. I will do that again. The students loved the lesson, specially making the pizzas. I had originally thought of doing paper pizzas, BUT I followed Math-Ese Participants suggestion of having them make their own pizzas. I sure wish their poster tree diagrams had been a little neater, but they turned out just fine. I feel fairly good about the lesson overall even though at times I believe I may have asked too much from my second graders. Before we completed the poster tree diagram, we completed one on the SmartBoard as a class. This served as a reference for the children and seemed to ease their minds about doing the tree diagram.

B. Your thoughts on the pre/post test. How did students react to the pre-test? Did they do as well on the post-test as you expected? Why or why not? What changes would you make in the pre/post test next time-why?

The students did not want to do the pre-test. They were very concerned because they could not complete basically anything on the test. I told them that is was not for a grade and they relaxed a little, but I could not get them to turn in their papers if they had completed what they knew that for most was nothing. They would not turn it in. I finally had to go one by one and telling them that is was ok. As we completed the lesson, they were excited to say things like this, “Oh, I get it now. Now I can answer that question from the pre-test.” Only one student used the figures in the baggie to make the clothing combinations and this student actually drew every single combination correctly. I was very disappointed in the answers to the first question which was: What is a combination? We talked about the definition and simplified it into shorter words and most of them did answer as well as I expected. I would like to change the format of the pre and post-test, but would like suggestions from other grade 2 teachers. I really hope I was not asking too much from them. Since I moved down from teaching 6th grade this concern always hits my mind quite often.

C. Your thoughts on the journal activity. In your professional opinion, do you believe the journal activities helped the students? All of them? Did it “hurt” some? Why? Will you continue to use some type of journal activity in the future?

I believe journal activities do help the students and the teacher. My journal this year has a prompt to begin class, which is often a word problem of the type we are working with in class. The final journal activity of day reflects on one thing they learned that day. I would like to improve the format by adding a place for them to reflect on one thing they learned in the previous day’s lesson. I also think it does “hurt” some students because it frustrated them to have to answer “why” questions. We had a rough beginning of the year with the journal idea, but now it is just part of the day. It would have been very easy to just give up because it does take some time to think of the prompts and match them to instruction, but I really like the benefit of catching when a student has not grasped a concept and helping to avoid further frustration. I will continue this journal for the remainder of the year and will use the prompts that I create this year for future years, making any changes as needed.