Lesson Title: Algebraic Thinking – Patterns and Functions
Grade: 1

Curriculum Area: Mathematics
Grade Level: 1
Time Required: 30 Minutes

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Instructional Groupings: Group of 5

NCTM
Content Standards: Algebra
Process Standards: Illustrate general principles and properties of operations, such as commutativity, using specific numbers; use concrete, pictorial, and verbal representations to develop an understanding of invented and conventional symbolic notations.

NB Mathematics Curriculum Grade One

1. Describe equality as a balance and inequality as an imbalance, concretely and pictorially (0 to 20). [SCO-PR3]
2. Record equalities using the equal symbol. [SCO- PR4]

Overview
Most children in the class will be able to count to twenty and many to 100. They will also demonstrate an understanding of addition and subtraction to 20. The goal of this lesson is to ensure that students understand that not all numbers are equal (some are greater than, and others are less than), and that the equal sign does not merely mean 'this is the answer' or 'get the answer'. This activity will require that students apply their prior knowledge of addition but they will be using manipulatives for the activities so if a student is still struggling it shouldn't hinder their understanding of this concept (they will also be doing the activity sheet in pairs so they will be able to seek help from their partner if necessary).

Purpose / Objective
The purpose of this lesson is to introduce students to the notion that the equal sign means that the function on one side the equation is the same as the function/number on the other side (they are balanced).

Assessment
Students will hand in their activity sheet at the end of class to the teacher for marking (they may work in pairs to complete the assignment if they choose to).

Materials & Preparation
Each Student will need…

- Warm-up activity template
- Activity questions template

- 2 clear cups
- A piece of string (about 30 cm)
- Scotch tape
- 20 jujubes

Teacher will need:

- Scale
- 2 clear cups
- A piece of string (about 30 cm)
- Scotch tape
- 20 jujubes

Activities and Procedures

1. Begin the lesson by reviewing what is means for a number to be 'greater than' and 'less than' another number. Ask the students to briefly summarize what that means then write the following series of numbers on the board:

   10 3 6 5 3 18 20 14 19 7 12

   Ask the students to write down the series of numbers in their notebooks and to identify (keeping the numbers in the same order) whether or not the number is 'greater than' or 'less than' the number in front of it. Give the students a couple minutes to answer the questions individually. When they have completed this task, ask for volunteers to come write one answer on the board. If any answers are wrong than discuss why that is so. The purpose of this quick activity is to refresh students' of their previous knowledge of thinking algebraically.

2. After reviewing the 'greater than'/'less than' principle, the teacher will distribute a sheet with the numbers 1-20 and 1-50 to each student. The teacher will select a number (but not tell the students), and then give them hints for them to figure out which number they have chosen using the 'greater than' and 'less than' language. As the teacher goes along giving the hints the students are encouraged to cross out the numbers that they know it isn't based on the teacher's hints. Note that some of the more advanced students may be able to do this mentally and that is acceptable- the handout is to help the visual learners.

   Round 1:

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20

   Example if the teacher's number is 4…

Hints:

1. The number is greater than 2.
2. The number is less than 18.
3. It is an even number.
4. The number is less than 8
5. The number is not 6.

Answer: 4

Round 2:

(Now that they understand the concept of the activity you can increase the difficulty by having the numbers 1-50)

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50

Hints:

1. The number is smaller than 44.
2. The number is greater than 10.
3. The number does not have a 2 in it.
4. The number is more than 13.
5. The number is less than 35.
6. The number is uneven.
7. The number is greater than 15.
8. The number is smaller than 19.

Answer: 17

*If the students don't fully understand the 'great than' and 'less than' concept you may want to play this game one more time before moving on.

3. After reviewing the 'great than' and 'less than' concept, we are going to move on to working with the 'is the same as' concept. To begin you will give all the students the required materials to build their own scales (2 clear cups, piece of sting, bag of 20 jujubes) and show them how to make their own scale. The bellow illustrations demonstrate how to make a balanced scale and use one.

Materials:	Step 1:
Step 2:	How to use it:

4. Once everyone has finished his or her balance you can begin the core of the lesson. Begin with a simple demonstration:
    - Put four jujubes on one side of the balance and one on the other. Then ask the following three questions:
    1. Is there the same number of jujubes on both sides?
    2. How you we balance the scale?
    3. How did you know that there wasn't the same amount of jujubes on both sides? (Hopefully the students will remember the 'less than' and 'greater than' concept from the warm up to explain this, but if not than the teacher should bring it up again)

5. Put 10 jujubes on one side, and 7 on the other and ask the students if there are an equal number of jujubes on either side of the scale.
    - Explain that this is an inequality because there is a tilt in the scale (this is because there are more jujubes on one side than the other)
    - Demonstrate how you can balance the scale by adding 3 jujubes to the side with 7.

6. Write the equation on the board and get the students to use their own scales to follow along and balance the following equations:

    $5 = 3 + \square$ Answer: 2

2 + 1 = 1 + ☐ Answer: 2

State whether the following equations are balanced of unbalanced/tilted.

4 + 8 ☐ 12 Answer: Balanced

15 + 5 ☐ 8 + 12 Answer: Unbalanced/Tilted

How many jujubes would you have to put on to make the following equations tilt/unbalanced?

2 + 2 ☐ Answer: ANY number but 4 (smaller or larger)

4 + 9 ☐ Answer: ANY number but 13 (small or larger)

7. Before handing out the second activity (which is attached to the lesson plan) ask the students if they have any questions.

8. Hand out activity sheet explaining to students that it can be done individually or in pairs but everyone has to hand in their own copy to the teacher at the end of class for marking.

9. If time permits, ask students to share with class the questions they made up for the last question.

Follow up

1. Students will ask their partners the questions they made up on their activity sheets.
2. Students now get to enjoy eating their jujubes!
3. Teacher is available to answer any outstanding questions.

Topic Summary

Chapter 14 in *Elementary and Middle School Mathematics*, "Algebraic Thinking: Generalizations, Patterns and Functions", covers a lot of content. For the purposes of my lesson plan I focused on the meaning of the equal sign as the authors stressed that it is often misunderstood by students because teacher misrepresent what it really represents. Furthermore this chapter goes into significant detail about recognizing patterns and creating graphs with dependant and independent variables.

As a student progresses through the public school system they increasingly explore more complex algebraic concepts and that is evident in this chapter. Although the importance of the equal sign is emphasized, a great deal of this chapter is dedicated to the importance of patterns as well. Patterns are far more complex then merely recognizing one- one must be able to extend a sequence, simplify expressions and equations, use variables with unknown values, graph functions etc. Algebraic thinking progresses in a chronological order and you must understand the foundation of the equal sign and recognizing a pattern prior to advancing and exploring complex functions.

In conclusion, Chapter 14 offers a brief overview of the progression of algebraic thinking ranging from kindergarten to middle school. Additionally, it gives the reader insight into what students at each grade level are learning in terms of algebra and it offers a number of valuable activities for teacher to apply in a classroom.

References

National Council of Teachers of Mathematics. (2012). *Algebra*. Retrieved from http://www.nctm.org/standards/content.aspx?id=312

New Brunswick Department of Education. (2008) *New Brunswick Grade 1 Mathematics Curriculum Guide* (Title Code: 844390). Retrieved from https://portal.nbed.nb.ca/

Van de Wall, J., Folk, S., Karp, K., & Bay-Williams, J. (2011). (3rd Canadian ed). *Elementary and Middle School Mathematics: Teaching Developmentally*. Toronto, ON: Pearson.