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Algebra in the Elementary Grades

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Introduction

Algebra is one the cornerstones of mathematics. The National Council of Teachers of Mathematics (NCTM) has included algebra as one of the standards for K-12 mathematics (NCTM, 2000). In the elementary grades, the focus of this standard should be on developing algebraic thinking through modeling, generalizing, and justifying. According to Cuevas and Yeatts (2001) “Algebraic thinking begins with the very young, expands and deepens and matures through the years, and continues to serve adults long after the end of formal schooling” (p. 1). Teachers need to incorporate a variety of activities into their lessons that help students develop this algebraic thinking. Textbooks do not always provide activities that motivate students and make them eager to work the problems. However, if teachers will spend a little time on the Internet and peruse supplemental materials, they can find highly effective activities that will interest the students and keep them engaged. There are many websites that contain interesting activities for students to help increase their algebraic thinking. Some of these include:

eyepleezers.com/aaamath/equ.htm
rainforestmaths.com
k111.k12.il.us/KING/math.htm
brainpop.com/math/algebra
mathforum.org/varnelle/kalg.html

coolmath4kids.com
mathplayground.com/Algebra_Puzzle.html

In addition to these websites, the following activities can help elementary school students with algebraic thinking.

Activities

Activity 1 (Grades K-2) – *Finding 10*

Materials: A set of number cards 0-9 for each student

- (1) Each student has their own set of number cards 0-9. The cards are shuffled and placed face down in front of each student.
- (2) In turn, each student draws a card and tells what number must be added to that card to make 10.

Activity 2 (Grades 1-2) – *Odd or Even*

Materials: A set of number cards 0-9 for each student

- (1) Each student has their own set of number cards 0-9. The cards are shuffled and placed face down in front of each student.
- (2) In turn, each student draws a card and tells if the number drawn is even or odd.
- (3) (Counters can be used by the student to make a one-to-one correspondence; if there is one counter left over, the student knows the number is odd; if the counters come out with a one-to-one correspondence, the student knows the number is even).

Activity 3 (Grades 1-4) – *Number Families*

This is a teacher directed activity.

- (1) On the board, the teacher writes a number family (e.g., 5, 8, 13).
- (2) The students must write the equations (addition and subtraction) for this number family ($5 + 8 = 13$; $8 + 5 = 13$; $13 - 8 = 5$; $13 - 5 = 8$).
- (3) This also can be done for multiplication and division.

Activity 4 (Grades 1 -3) – *Finish the Equation*

This is a teacher directed activity. The teacher writes a number on the board and asks the students to make an equation that uses that number as the answer. For example: 5.

Some possibilities are $2 + 3 = 5$; $1 + 1 + 1 + 1 + 1 = 5$; $8 - 3 = 5$; $5 \times 1 = 5$; $10 \div 2 = 5$. All contributions are written on the board.

Students can then examine each one and ask for justification (if necessary).

Activity 5 (Grades 1-4) – *Hidden Numbers*

This is a teacher directed activity. The teacher writes several equations on the board (mixing horizontal and vertical forms). This should be done before the students enter the classroom. One number in each equation is covered up with a 3 x 5 card or a sticky note. Examples include: $9 + \square = 16$; $\square \times 8 = 24$; and $32 \div \square = 4$. The students must then decide what the hidden number is in each equation. This can be done in small groups or individually. Students must be able to justify their answers. After discussion of each problem, the teacher uncovers the hidden number.

Activity 6 (Grades 3-5) – *Equalities/Inequalities*

Materials: Two sets of number cards 0-9 and two index cards (one with the = sign and one with the < sign) for each student

- (1) Each student has their own set of number cards (20) and index cards with the symbols (2). Students should be in small groups of 2-4.
- (2) The cards are shuffled and placed face down in front of the students.
- (3) In turn, each student draws two cards and must use the appropriate symbol between the two cards. The card with the less than (<) sign can be turned around as the symbol for the greater than sign (>).
- (4) After the correct symbol is placed between the two cards, the student must correctly read the equality or inequality aloud.

Activity 7 (Grades 2 and up) – *What's My Number*

This is a teacher directed activity. It can be done with transparencies already created or the teacher can write the problems on the board. They can be created at various levels depending on the abilities of the students. Here are some sample questions.

- (1) If you add 3 to me you get 9. What's my number? (6)
- (2) If you take 2 away from me you get 6. What's my number? (8)
- (3) If you add 5 to me you get 12. What's my number? (7)
- (4) If you divide me by 2 and add 5, you get 15. What's my number? (20)
- (5) If you multiply me by 3 and subtract 7, you get 5. What's my number? (4)

Activity 8 (Grades 5 and up) – *Sandwich Math (Addition of Integers)*

Materials: 2-color counters

- (1) Begin by laying 6 two-color counters on the table (3 red and 3 white). Tell the students that this is an addition problem. The white side represents positive integers and the red side represents negative integers. Whenever you have one of each color (white = +1 and red = -1) you put one on top of the other and make a “sandwich”. The white and the red pieces of the sandwich cancel each other to equal 0. How many sandwiches can be made with the counters on the table? (3). What is the sum? (0). Write the equation on the board $(-3 + 3) = 0$.
- (2) Lay 3 red and 4 white on the table. This is an addition problem. What is the sum? (+1). Equation: $-3 + 4 = 1$.
- (3) Try 5 white and 7 red. (The sum is -2) Equation: $5 + -7 = -2$.
- (4) Write several other addition equations on the board and ask the students to model the equation.

Activity 9 (Grades 5 and up)- *Sandwich Math (Subtraction of Integers)*

Materials: 2-color counters

- (1) Lay 5 white counters on the table. Tell the students that you want to take away 3 red counters from the white (The equation is $5 - -3 = ?$). How can you do it since you do not have any red? Since a red and a white equal zero, you can add zeroes (or sandwiches) to the problem without changing the answer. Add 3 zeroes (3 whites and 3 reds). Now you have the 3 reds to take away. Take them away. What’s left? (8 whites or +8).
- (2) Lay 6 red counters on the table. You want to take away 4 white counters (The equation is : $-6 - +4 = ?$). You need to add 4 zeroes (4 red and 4 white counters). Take away the 4 white counters (+4). What’s left? (10 red counters or -10).
- (3) Write several other subtraction equations on the board and ask the students to model the equation.

References

- [1] Cuevas, G.J., & Yeatts, K. (2001). Navigating through algebra in grades 3-5. National Council of Teachers of Mathematics, Reston, VA.
- [2] National Council of Teachers of Mathematics (2000). Principles and standards for school mathematics. Reston, VA: Author.

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