Chapter 21

Steven Mijajlovic: Solving Equations Using "The Blob"

Steven Mijajlovic earned a Bachelor of Arts in Accounting and Finance from Augustana College (Rock Island, IL). After his undergraduate degree, Steven went through an alternative teacher certification program partnered between Northwestern's NU-Teach program and the Chicago Teaching Fellows. He recently earned a Master of Science in Education with a focus in Secondary Mathematics Education at Northwestern University where Steven's research focused on mental math and pushing student thinking. Currently he is working on a Graduate Certificate in STEM Learning and Leadership through Michigan State University. Steven believes that modeling mathematics, in addition to inquiry and problem based learning is essential for student engagement and success in a mathematics classroom.

Solving Equations (One-, Two-, and Multi-Step Equations) Using "The Blob"

Grade Level: 7-9

Content Area Topic: Mathematics (Algebra)

Content Area Standard(s):

- CCSS.MATH.CONTENT.HSA.REI.A.1: Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.
- CCSS.MATH.CONTENT.HSA.REI.B.3: Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.
- CCSS.MATH.CONTENT.HSA.CED.A.1: Create equations and inequalities in one variable and use them to solve problems.
- CCSS.MATH.CONTENT.HSA.SSE.B.3: Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.

Learning Objective(s):

- Solve equations using properties of operations and the logic of preserving equality.
- Articulate the "common sense" behind rules of algebraic manipulations.
- Develop mathematical language related to calculations and equations.
- Developing a deeper understanding of what equations are by reinforcing number sense.

Suggested Time Allotment:

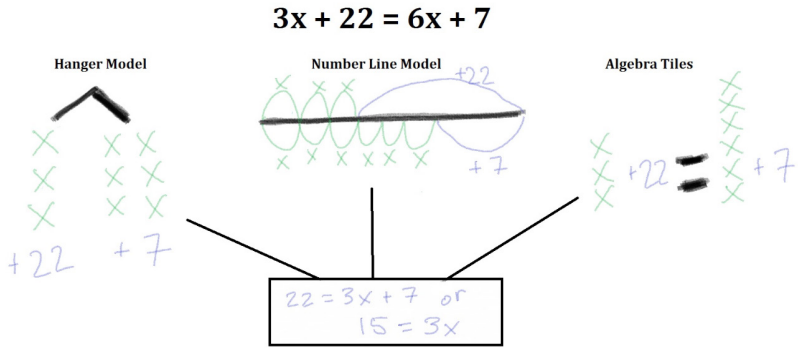
Depending on the types of equations, 1-3 class periods (50 minutes)

Sequence in Learning:

Prior to this lesson, students will need a basic understanding of the number line and basic facts of arithmetic. Essentially meaning that students must understand the idea of opposite numbers equal zero, how to add and subtract positive and negative numbers, and multiplication rules/patterns (multiplying same signed numbers results in a positive solution and multiplying different signed numbers results in a negative solution).

Students are expected to be able recognize basic algebraic operations, which entails various ways that multiplication and division can be represented (and). Additionally, students must understand the idea of equality – one side of the equation must equal, or be balanced, to the other side of the equation.

Lessons to follow this could be solving equations with variables on both sides of the equals sign. These types of equations can also be modeled using a hanger method to represent a balancing point, a number line model with "jumping" and "stepping," or algebra tiles. See pictures below of their respective models.



Materials & Resources Needed:

- Video (http://smijaj.weebly.com/Blob.html)
- Table white boards
- Play-doh (Optional for the *Blob*)
- Student handout – hand out attached.

Lesson Activities & Sequence:

Students will watch the video (http://smijaj.weebly.com/Blob.html) first of a two-step equation being solved using the Blob. They will individually answer the reflection questions at the top of the handout, then discuss with their table, and then we will share ideas as a class. At this point, the next three problems (examples 1, 2, and 3) will be done as a class, asking students what they think the appropriate steps are in order to go about solving the equations. The students will complete the last two problems (examples 4 and 5) as a table – students will be asked to put their work on their table white boards for both of the problems. After a given amount of time, students will hold up their boards and compare their solutions to the other groups. Some groups may be asked to present and share their work with the rest of the class. Students will be homogenously grouped by ability. In my classroom, students are grouped according NWEA RIT band levels (< 210, 210 – 230, >230). Flexible group could also be used.

Proficiency:
A few checkpoints for a progression of understanding will be the discussion after the video (What do you think the purpose of the Blob is? And How do you know where to put the Blob?), the table white boards for examples 4 and 5, how the students are progressing through practice, and then the following day students will have a "Check In" (Homework quiz) on five problems of varying difficulty. This formative assessment can be differentiated by groups – different groups of students can be expected to solve varying levels of problems. Successful responses can be measured at varying levels – students can be successful by identifying where to place the Blob, being able to explain why the placement of the Blob would work, being able to accurately solve an equation using the Blob, and for higher students, challenge them to solve equations using a mental Blob and showing no work.

Evaluation of these various formative assessments will mainly be based on accuracy. Most grading will occur on a 0 – 3 point scale: 0 is no work shown, 1 is little understanding, 2 is strong foundational understanding but some work still needs to be improved, and a 3 represents full understanding of the concept. If a student makes a small arithmetic error, however, has the premise of solving an equation, a 2 will be earned; a 3 can only be earned with no errors.

Feedback

Teachers As Learners:
Learners were continuously asked to explain their thinking when solving problems as a group, especially problems 1 through 3 which started the lesson off after the video. Learners are able to access the hand out virtually and use a tablet (if accessible) to work through the lesson. Some learners may also want to use a physical, tangible "Blob" (play-doh) to cover and uncover the unknowns as they work through the problems.

Elements of Pretty Good Practice:
Teacher started with discussion basic one step equations to get students thinking about solving for unknowns. Teacher asked learners to explain thinking or "how did you get that?" This prompts learners to understand the process of algebraic solving and also helps other learners possibly see a different problem solving technique. Teacher encouraged collaboration "turn to your elbow partner," teacher encouraged explanation "how did you get that?" and teacher modeled and encouraged multiple problem solving strategies.

Modifications and Adaptations:
This lesson can be differentiated at various points of entry and through the practice problems. Higher groups could watch the video on the own, and work through the guided examples on their own, while the other levels of students watch the video and participate in the class discussion, then work through the guided examples with the class. Additionally, students can be supported according to their level and depending on their abilities. The differentiation of the assignment can also be taken into consideration, and different groups of students can be held accountable for different problem sets, or completing different amounts of problems at different levels.
Have the class name the blob, class color the blob, or color coding the blob for different levels or problems

Questions Arisen:
Contextual scenarios where students create equations then solve using the Blob
Solving literal equations using the Blob – get the Blob alone this time
How would you extend this to having students create their own "Blob" problem and recording on Educreations, apply to a physics problem (F=ma), or literal equation manipulation?

Peer Feedback:
- Have student work through their own problem and ask their own questions (write them down)
- Have student make their own videos and teach the younger students – **#QuickFire** station make a lesson on the tablet
- Use play-doh as the Blob
- Silent video a plus!

Bibliography:
http://www.corestandards.org/Math/Content/

Related Resources/Ideas:
- http://www.educreations.com/lesson/view/using-the-blob-to-solve-a-two-step-equation/22907469/?ref=link
- http://ttalgebra.edc.org/
- http://www.worksheetworks.com/math/pre-algebra.html