Overview

This presentation introduces literacy strategies that build disciplinary language and learning important to learning mathematics, grades 6-12.

Session Outcomes

I can use the **Rule of Four** so that I can help students

- make and convey meaning using language and text valued in mathematics;
- build and deepen mathematical content knowledge; as well as
- develop valued critical thinking, problem-solving and analytical skills (a.k.a. Common Core Standards for Mathematical Practice).
Disciplinary Literacy & Learning Mathematics

The Common Core State Standards in Mathematics (National Governors Association, 2010) represent the aggregate of mathematical knowledge, skills, abilities, habits and attitudes deemed essential to learning mathematics. These Standards also represent a modern-day view of mathematics as the science of patterns. When we consider the Rule of Four (i.e., geometric, numeric, analytic, and verbal representations) to understand the specialized ways that students learn and become literate in mathematics, the connection between disciplinary literacy and learning of mathematics becomes clear. For further information about the Rule of Four, we recommend the following websites:

http://www.learner.org/workshops/algebra/workshop5/teaching.html

http://calteach.ucsc.edu/People_/Instructors/documents/Rule%20of%20Four.pdf

Ideas important to Universal Design for Learning (or what we like to call universal supports for learning) are also worth noting, especially in terms of providing students with multiple means of representation (Principle 1) and multiple means of action and expression (Principle 2). For more information, see: http://www.udlcenter.org/implementation/examples.

In the next section, we share literacy strategies that thoughtfully and productively build disciplinary language and learning important to using the Rule of Four to learn mathematics in grades 6-12.

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Strategy 1: Mind Mapping

(Adapted by S. Cimbricz & M. Gruver)

Presenter: Meagan


Overview:

This strategy asks students to convey and represent their understanding of mathematical ideas and concepts graphically and in the form of networks. Mind maps importantly differ from graphic organizers in the sense that relationships between and among ideas and concepts are critical.

Steps:

1. Place topic in the center of the paper in an eye-catching way, preferably as a colored image. The topic should literally be the center of attention.

2. From the topic, draw a main branch for each of the main ideas linked to the topic. If a special order is appropriate, the branches may be numbered or ordered clockwise.

3. From the main branches, draw further lines (sub-branches) for secondary ideas (sub-topics) as needed. Color code if possible.

4. Use the Rule of Four to assess if multiple and varied representations of the topic are present.

NOTE: The mind map follows this principle: Move from the abstract to the concrete and/or from general to specific. The hierarchical structure and relationships of ideas and concepts are therefore important.
Strategy 2: Gallery Walk  
(Adapted by S. Cimbricz & M. Gruver)

Presenter: Meagan


Overview:
The term “gallery walk” is usually used to describe the viewing of an art exhibit where people mill about, interpreting and commenting on the art that is hanging on display. A similar experience can be simulated in the math classroom with graphs and tables displayed—like art—around the room for student viewing, conversation and understanding. In groups of two, students assess the general trends in the graphs/tables and create possible scenarios or stories depicted by the data. As they visit each visual, students share their thinking as a story or scenario.

Steps:
1. Display graphs and tables around the room like artwork. The more varied they are, the better.  
2. At the beginning of the lesson, review what they know about graphs and tables (e.g., how to read, what information they provide).  
3. Assign partners to a particular graph/table. Their task is to figure out what data is explicitly presented and then, create a scenario or story based on the data depicted.  
4. Provide these scaffolding questions at each “picture.”
   a. Describe the “picture.” What “is” it? What do you see? Why might that be?  
   b. If this data tells a story, what story does this data tell you? Specifically, what happens in the beginning? What happens in the middle? What happens in the end? (This graph tells a story….)
   c. How does all of this relate to what you've learned and/or are learning in math?  
5. Students record their ideas for each picture and leave their tracks of their thinking for other groups to read (e.g., a Graffiti Wall). The groups will rotate and repeat the process for each graph/table. Encourage students to read their peers’ ideas and discuss them with their partner. During this time, the teacher should circulate around the room, observing each group’s work and leaving comments or questions on sticky notes in response to student thinking.  
6. When every group has visited all of the graphs/tables, debrief with the whole class. Revisit the scaffolding questions and ask students to share the stories they created. Encourage students to use their mathematical knowledge and vocabulary as they share.  
7. Next steps: How might they represent their ideas algebraically? (Revisit the Rule of Four.)
Strategy 3: Vocabulary Knowledge Ratings for Closer Reading
(Adapted by S. Cimbricz & K. Moulin)

Presenter: Katrijn & Sandra


Overview:
This strategy is crucial to building strong vocabulary learners and helping “students gain awareness of the extent and limits of their word understanding, and track it over time” (Spencer & Guillaume, 2009, p. 41). Such a strategy provides students with metacognitive strategies that help build awareness and vocabulary knowledge.

Steps:
1. Select target vocabulary words to be encountered and developed in the lesson and text. Limit the list to fewer than 10 words.
2. Ask the students to rate the vocabulary words listed into the three categories: I can teach it, I have seen it, and I have no idea.

<table>
<thead>
<tr>
<th>Word</th>
<th>I can teach it.</th>
<th>I have seen it.</th>
<th>I have no idea.</th>
</tr>
</thead>
</table>

3. Ask students to highlight the vocabulary words in the text (you provide). What do you notice? (e.g., Do some words occur more frequently than others? What words are NOT there?)
4. The text you provide should have a problem likely to intrigue your students. Use that problem to establish a purpose for reading. Example: You’re going to hear a story about Emily. Emily’s teacher is having them look at all their previous test scores before the last test for the school year. Emily has a problem. The question is: What might that problem be?
5. Read the text aloud and ask them to share what they think the problem is. Their goal is to “get the gist” and identify the problem.
6. Then ask students what questions they would ask to answer this question. Encourage them to draw on their vocabulary rating knowledge sheet as it provides “foreshadowing.” What words do they think will be helpful to solve the problem? Here the teacher can provide direct and additional support depending on what students need.
7. Annotate the text to identify information important to solving the problem. Ask students to experiment with how they think they can solve the problem and in turn, share their strategy, process, and “solutions” with a partner. Then share these ideas with the class.
8. Remind students to be mindful of the Rule of Four and mathematical ways of talking as they share what they did.
Strategy 4: Concept Sort (Adapted by S. Cimbricz & K. Moulin)

Presenter: Katrijn


Overview:

This strategy is powerful because it allows the students to see and show connections between the terms and overarching idea. The ultimate purpose of a concept word sort is to help students understand how concepts are related, specifically if the concepts are hierarchically linked. The Concept Sort is related to List-Group-Label, but the graphic importantly asks student to demonstrate the “inter-relatedness” of ideas explicitly. If students use a particular graphical layout, they should be able to explain how and why that lay out matters.

Steps:

**Concept Sort**
1. Present students with key vocabulary OR brainstorm all the words related to a particular topic.
2. Ask students to figure out ways to group the words.
3. After they categorize the words into groups, ask students to share the thinking, explain the rationale behind their sort, and how they would “lay out.” If students do not understand some of the words, the words should be set aside and then discussed as a class.

![Central Tendency
- Mean
- Median
- Mode

Descriptive Statistics

- Frequency Distribution

Dispersion
- Range
- Standard Deviation
- Variance

Distribution

![Central Tendency
- Mean
- Median
- Mode

Descriptive Statistics

- Frequency Distribution

Dispersion
- Range
- Standard Deviation
- Variance

Distribution

Strategy 5: Concept Map (Adapted by S. Cimbricz & K. Moulin)
Presenter: Katrijn


Overview:
The Concept Sort Strategy logically leads to Concept Mapping. Concept maps are similar to the Concept Sort and Mind Map in that relationships between and among ideas and concepts are critical. An important distinction with concept maps, however, is that the lines or connectors between and among ideas are specified.

Steps:
Concept Map
1. Place topic clearly at the top of the map. (You are ultimately creating a flow chart [which can be vertically or horizontally displayed].)
2. Arrange other ideas or concepts around the topic. Move from the abstract to the concrete and/or from general to specific. Remain open to the idea that there may be more than one valid way to rank the concepts, depending on how one interprets the relationships between ideas.
3. On the connecting lines, write words or phrases that explain the relationship. This is the most important and difficult step!
4. Sometimes it is useful to apply arrows on linking lines to point out that the relationship expressed by the linking word(s) and concepts is one direction. It is also important to consider transition words such as “for example.”
Strategy 6: Four Corners: Which Rule of Four “rules?”
(Adapted by S. Cimbricz & J. Damick)
Presenter: Jennifer
Source: http://oame.on.ca/main/files/thinklit/FourCorners2.pdf

Overview:
For this strategy, students consider a big idea in relation to the Rule of Four. It’s important to note that the argumentation is important to this strategy; otherwise, the learning becomes more focused on vocabulary.

Steps:
1. Create a statement or question for students to ponder the Rule of Four. The state or question should have the potential for varying degrees of agreement or preference.
2. Ask students to review each representation in relation to the larger question posed. We suggest ask what “representation” is best (depending on what situations, for whom, and when or purpose, audience and context).
3. Ask students to choose examples that they think best represents a particular mathematical idea or concept. They should then explain why this representation is the “best.”

GRAPHICAL
NUMERICAL

ALGEBRAIC
Use the SKEW() function in Excel or OpenOffice Calc.

VERBAL
For the negative: To the left! To the left! For the positive: To the right! To the right!
(with apologies to Beyoncé)
**Strategy 7: Four Corners: Where Do you stand?** (Adapted by S. Cimbricz & J. Damick)

Presenter: Jennifer


Source: [http://oame.on.ca/main/files/thinklit/FourCorners2.pdf](http://oame.on.ca/main/files/thinklit/FourCorners2.pdf)

**Overview:**

*Where Do You Stand?* is a literacy strategy “designed to get students out of their seats” and “into thoughtful written and out-loud discussions” (p. 110). After examining a text that invites argumentation, students literally walk to labeled areas to indicate the stand they take. For example: Do they agree? Disagree? Agree or disagree, but with conditions? Do they have “NMI” or need more information?

**Steps:**

1. Create a statement or question for students to ponder that has the potential for varying degrees of agreement or preference. Make the question worthy and intriguing.

2. Organize the room into four areas (corners) according to four possible stances: agree, disagree, agree or disagree with qualification, and need more information (NMI). You may also vary responses to other possibilities such as Yes, No, Yes/no but or Totally unsure.

3. Give students ample time (2 to 5 minutes) to think about the question, develop a response, and take a stance. Encourage students to make their own choices. Questions posed should mathematical worthy and inspire student-led inquiry. Immerse them in the problem-solving and avoid teacher front-loading.

4. Ask students to move to one of the four corners that best represents their response to a question. Direct students to get into groups of two (if possible) to discuss the reasons for their choices. In cases where the groups are not large enough, pairs may be formed. In cases where only one student is in a group, the teacher could act as the other member of the pair.
Strategy 8: Jigsaw
(Adapted with materials created by J. Dubay)
Presenter: Joshua

http://www.adlit.org/strategies/22371/

Overview:

Jigsaw is a strategy that emphasizes collaborative learning by providing students the opportunity to actively learn math from and with each other. Each group member is responsible for becoming an "expert" on one section of the assigned material and then “teaching” it to the other members of the team. Jigsaw helps students share responsibility and accountability for each other's learning by using critical thinking and social skills to complete an assignment. This strategy has been adapted to use the kind of text valued in mathematics. As a result, the development of mathematical literacy, thinking and content knowledge can be developed.

Steps:

1. Pique students’ interest by introducing the concept to be learned by way of a mathematical puzzle or riddle (e.g., The Man at St. Ives (http://mathworld.wolfram.com/StIvesProblem.html)
   The puzzle should spark student interest and yet, richly connect to the content to be learned.

   I was going to St. Ives,
   I met a man with seven wives.
   Every wife has seven sacks,
   And every sack had seven cats.
   Every cat had seven kittens
   Kittens, cats, sacks, wives
   How many were going to St. Ives?

2. Ask students to predict questions that the riddle might answer and how they might solve the riddle.
3. Connect the riddle to the mathematical jigsaw and distribute handout. Their goal is for students to become experts on an “individual property.” (See below).
   a. Students are provided with different exponent properties worksheets.
   b. Provide information so that classmates can sufficiently complete their table.
   c. Allow time for groups to complete examples before beginning presentations.
4. Each student will have the opportunity to present—to their peers—their knowledge of the exponent property on which they became an “expert.”
5. Close the lesson with the “Exponent Properties Dance” to highlight what they learned and to help students remember properties of exponents in the future.
Teacher-Provided JIGSAW worksheet

Teacher-Provided Exponent Properties worksheets:

<table>
<thead>
<tr>
<th>Properties of Exponents</th>
<th>Algebraic Representation</th>
<th>Numeric Representation</th>
</tr>
</thead>
<tbody>
<tr>
<td>The product of powers property tells us that when you multiply powers with the same base you just have to add the exponents.</td>
<td>( x^a \cdot x^b = x^{a+b} )</td>
<td>Example: Simplify in exponential form. ( 3^5 \cdot 3^4 )</td>
</tr>
<tr>
<td>The quotient of power property tells us that when you divide powers with same base you just have to subtract the exponents.</td>
<td>( \frac{x^a}{x^b} = x^{a-b}, \quad x \neq 0 )</td>
<td>Example: Simplify in exponential form. ( \frac{10^8}{10^6} )</td>
</tr>
<tr>
<td>The power of a power property tells us that to find a power of a power you just have to multiply the exponents.</td>
<td>((x^a)^b = x^{a\cdot b})</td>
<td>Example: Simplify in exponential form. ((4^3)^2)</td>
</tr>
<tr>
<td>When you raise a number to a zero power you’ll always get 1.</td>
<td>( \frac{x^a}{x^a} = x^{a-a} = x^0 ) ( x^0 = 1, \quad x \neq 0 )</td>
<td>Example: Simplify in exponential form. ( \frac{5^9}{5^9} )</td>
</tr>
</tbody>
</table>
Strategy 9: Problem-solving Discussion Protocol  
(Adapted with materials created by J. Dubay)  
Presenter: Joshua

Related Link(s): http://www.shelovesmath.com/algebra/intermediate-algebra/systems-of-linear-equations/

Overview:

The Problem Solving Discussion Protocol is a strategy where students are given an open-ended, complex mathematics problem and work with a partner to solve the problem. To guide their problem solving, students are given a protocol designed to promote reflection on both the means and ends of problem solving (i.e., what students choose to do, how and why they did it, how they know it was effective, and what else they might choose to do as result).

Steps:
1. Students examine a mathematics word problem that piques their curiosity.
2. Following PROBLEM SOLVING DISCUSSION PROTOCOL, students will identify and discuss with a partner what the problem is asking them to solve.
3. Then, students are asked to analyze why the problem is occurring.
4. Next, students design a plan for solving the problem.
5. Finally, students respond to the problem and decide if their solution “worked” and consider how and why it did. They then consider other classmates’ solutions to learn of other ways to solve the problem, and what they, in turn, would do differently and why.
Materials: The Problem
“You’re going to the mall with your friends and you have $200 to spend from your recent birthday money. You discover a store that has all shirts for $25 and all jeans for $50. You really, really want to take home 6 items of clothing because you want that many new things. Find out how many shirts and how many pairs of jeans you can buy so you can use the whole $200 (tax not included – your parents promised to pay the tax).

Creating the System of Linear Equations
Let $s$ = the number of shirts you will buy
Let $j$ = the number of jeans you will buy

<table>
<thead>
<tr>
<th>English</th>
<th>Math</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>“You really, really want to take home 6 items of clothing because you want that many new things.”</td>
<td>$s + j = 6$</td>
<td>If you add up the shirts and the pairs of jeans, you want to come up with 6 items.</td>
</tr>
<tr>
<td>“…you have $200 to spend from your recent birthday money. You discover a store that has all shirts for $25 and all jeans for $50.”</td>
<td>$25s + 50j = 200$</td>
<td>Place the variables in with their prices, and they have to add up to $200</td>
</tr>
</tbody>
</table>

Solving Systems with Substitution

<table>
<thead>
<tr>
<th>Steps</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>$s + j = 6$</td>
<td>Solve for $j$: $j = -s + 6$. Plug this in for $j$ in the second equation and solve for $s$.</td>
</tr>
<tr>
<td>$25s + 50j = 200$</td>
<td>When you get the answer for $s$, plug this back in the easier equation to get $j$; $j = -(4) + 6 = 2$</td>
</tr>
<tr>
<td>$25s + 50j = 200$</td>
<td>So the solution is $(4, 2)$.</td>
</tr>
</tbody>
</table>

Solving Systems with Linear Combination or Elimination

<table>
<thead>
<tr>
<th>Steps</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>$s + j = 6$</td>
<td>Since we need to eliminate a variable, we can multiply the first equation by $-25$. Remember that we need to multiply every term by the $-25$.</td>
</tr>
<tr>
<td>$25s + 50j = 200$</td>
<td>Then we add the two equations to get “0$s” and eliminate the “$s” variable. We then solve for “$j”.</td>
</tr>
<tr>
<td>$(-25)(s + j) = (-25)(6)$</td>
<td>Now that we get $j = 2$, we can plug in that value in either of the original equations to get the other variable.</td>
</tr>
<tr>
<td>$-25s - 25j = -150$</td>
<td>So the solution is $(4, 2)$: $s = 4$ and $j = 2$.</td>
</tr>
<tr>
<td>$25s + 50j = 200$</td>
<td></td>
</tr>
<tr>
<td>$0s + 25j = 50$</td>
<td></td>
</tr>
<tr>
<td>$25j = 50$</td>
<td></td>
</tr>
<tr>
<td>$j = 2$</td>
<td></td>
</tr>
<tr>
<td>$s + j = 6$</td>
<td></td>
</tr>
<tr>
<td>$s + 2 = 6$</td>
<td></td>
</tr>
<tr>
<td>$s = 4$</td>
<td></td>
</tr>
</tbody>
</table>
Solving Systems by Graphing

Put these equations into $y = mx + b$ format, by solving for $j$.

- $s + j = 6$ solve for $j$: $j = -s + 6$
- $25s + 50j = 200$ solve for $j$: $j = \frac{200 - 25s}{50} = -\frac{1}{2}s + 4$

To begin, solve for the “$j$” value like above, or use the intercept method. The easiest way for the second equation would be the intercept method; put 0 in for “$j$” and get 8 for the “$s$” intercept; put 0 in for “$s$” and get 4 for the “$j$” intercept.

The first equation can be solved this way too, or just solve for “$j$”.

The two graphs intercept at the point $(4, 2)$. This means that the numbers that solve both equations are 4 shirts and 2 pairs of jeans.
### Solving Systems using a Graphing Calculator

<table>
<thead>
<tr>
<th>Instructions</th>
<th>Screen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Make sure <strong>Plot1</strong> is turned off by moving cursor up to it and hitting <strong>ENTER</strong>. (if Plot1 is turned on, it would be highlighted)</td>
<td>![Image of graphing calculator screen with equations Y1=6-X and Y2=(200-25X)/50]</td>
</tr>
<tr>
<td>Push <strong>Y=</strong> and enter the two equations <strong>Y_1=</strong> and <strong>Y_2=</strong>, respectively. Note that we don’t have to simplify the equations before we have to put them in the calculator.</td>
<td>![Image of graphing calculator screen with equations Y1=6-X and Y2=(200-25X)/50]</td>
</tr>
<tr>
<td>Push <strong>GRAPH</strong>. Hit <strong>“ZOOM 6”</strong> (ZoomStandard) and/or <strong>“ZOOM 0”</strong> (ZoomFit) to make sure we see the lines crossing in the graph.</td>
<td>![Image of graphing calculator screen with equations Y1=6-X and Y2=(200-25X)/50]</td>
</tr>
<tr>
<td>(Also, use the <strong>WINDOW</strong> button to change the minimum and maximum values of the x and y values.)</td>
<td>![Image of graphing calculator screen with equations Y1=6-X and Y2=(200-25X)/50]</td>
</tr>
<tr>
<td>To get the point of intersection, push <strong>“2nd TRACE” (Calc)</strong>, and then either push 5, or move cursor down to <strong>intersect</strong>. <strong>“First curve?”</strong> should be seen at the bottom of the screen.</td>
<td>![Image of graphing calculator screen with equations Y1=6-X and Y2=(200-25X)/50]</td>
</tr>
<tr>
<td>Then push <strong>ENTER</strong>. <strong>“Second curve?”</strong> should now be seen and then press <strong>ENTER</strong> again. <strong>“Guess?”</strong> will now be seen. Push <strong>ENTER</strong> one more time, and get the point of intersection on the bottom.</td>
<td>![Image of graphing calculator screen with equations Y1=6-X and Y2=(200-25X)/50]</td>
</tr>
</tbody>
</table>
Strategy 10: traduciendo  
(Adapted by Carolina Ramos)


Overview:

Traduciendo the Rule of Four combines four varieties of representation of the same mathematical expression—as a word problem, using mathematical symbols, as a a table and a picture. The goal of “Traduciendo” the Rule of Four is to help students understand the many ways to represent the same idea mathematically.

Steps:

1. Introduce the concept of translation (“traduciendo” in Spanish ) by greeting the students in four different languages. Then ask if, by saying hi, hola, namaste, and bonjour, any meaning was lost in translation. Connect the idea of translation or traduciendo to the same phenomenon found in math. That is, in mathematics, we solve problems in diverse ways and can represent our solutions in different ways.

2. To give students choice, ask them to choose a number and write it down on a piece of paper.

3. Then ask them to: “Add 3 to your number and multiply that answer by two.” Have students record the solution on a piece a paper so they can remember what they did.

4. Show them how they just did a math word problem and that the next three steps will involve translating this word problem using mathematical symbols, a table, and a picture.

5. Have students substitute their number with the letter n and use mathematical symbols to translate the word problem of “Add 3 to your number and multiply that answer by two.” Ask students to share their translations with a partner and explain their translation.

6. Next, provide a table for students to complete with their chosen number.

7. The final step involves translating the word problem into a picture. Review how to obtain the area of a rectangle, and then ask students to draw a picture of a rectangle and do the translation using their number.

8. Foster metacognition by asking students to chose the representation that helped them to understand the math concept (of area) better. Assure them that are no right or wrong answers. (Note: Many students choose the algebraic or symbolic representation.)
Strategy 11: Lego House Model (Created by Carolina Ramos)

Presenter: Carolina

Overview:
Carolina created the Lego™ house model for the purpose of modeling the mathematical process of solving an equation. Simply following the many steps of solving an equation—without comprehending the “why” and “what” of pattern and procedure—is not only overwhelming for students, it does little to promote the learning of mathematics in a meaningful way. As Wallace and Evans (2013) remind, “a comprehensive grasp of mathematics can only come when learners recognize...that its purpose is to describe their world” (p. 5).

Each piece of the house represents the mathematical concepts that illuminate the fundamental concepts and steps for solving multi-step equations. The corresponding steps and pieces of the house are:
- Roof: Distributive property
- Ceiling: Combining like terms
- Walls: Four basic operations (addition, subtraction, multiplication, division)
- Foundation or floor: Checking your answer

Steps:
1. Make students sure are familiar with the definition of a variable (what is it?), the four operations and their inverse operations (opposites), adding like terms, and distributive property.
2. Show pieces of the house: foundation, walls, ceiling and roof. Show the owners of the houses: Mrs. Y, Mr. X and Mrs. A.
3. Introduce the first rule: “YOU CANNOT pull the owner out through the top of the house. The owner needs to come out by removing one or more walls.” Demonstrate the rule and explain the label of the pieces. On the walls, the students will find the symbols of the four basic operations: addition, subtraction, multiplication and division. On the opposite side they will find the inverse (opposite) operation. The ceiling is labeled with x’s and #’s. These labels represent combining like terms and where student might add the same variables and numbers. The last piece is the roof, which represents the distributive property. Model distribution using a piece of candy. Ask students to define this idea in their own words.
   Check in with students by asking them to solve a distributive math problem: 2( x+3)
4. Provide each student with a “building journal.” Prompt the students to write in their building journal the steps they take to build the house. Identify each step for them, but encourage students to write the steps in their own words so that they will remember and recall now (and in the future).
5. Introduce the second rule: “Whatever you do on one side you must do on the other side.” Ask students to give it “trial” run by building the foundation, the walls, and getting Mrs. Y into the house. Monitor student understanding. Introduce how the construction of the house relates to solving a one-step equation (e.g. x +1 = 8). Prompt students to write down the new step needed to solve the equation (following their Lego house rules). If all the students are able to solve the given one-step equation. move on to the next step. If not, have students practice a couple more examples solving one-step equations.
6. Next, students return to building their Lego house. This time the ceiling will be added. A new rule is introduced: “The owner of the house mandates that the ceiling be two different colors.” The representation of having two different colors relates to the idea of combining like term with one color representing one variable. Ask students to add this step in their building journal.

7. Introduce new math problem to help students review: $5x + 3 + 4 = 2x + 12 - 3$. Students will need to be able to solve the equation using the same steps and recognize the mathematical meaning of the ceiling (combining like terms). If all the students are able to solve the given equation, move on to the final step. If not, provide practice with a couple more examples.

8. Students build the complete house. In this final step, the roof will be added. The students then will be able to solve the multi-step equation.

Example
The following is an example of how to take the walls of the house out and play with the model, after doing a couple problems the students followed the pattern of:

$x + 1 = 7$

Look for the addition sign in the wall.

Take the addition wall out.

Apply the inverse operation (subtraction).

Recognize what operation $5x$ represents (multiplication).

Apply the inverse operation found in the back of the multiplication wall (division).