

Mathematics Strategies for Middle-School Students

“Think of the brain as a muscle. The more you use it the stronger it is.”

–Deborah Feldman, Mathematics Consultant

Mathematics Consultant and Educator Deborah Feldman shared the following strategies and activities with educators at the “Math Strategies for Middle-School Educators” training, held at Westfield State College on January 8 and 17, 2007.*

► Mathematics Autobiographies

This activity involves having students write down their thoughts about math. This can include the games they play that involve math, specific instances when they use numbers, how they feel toward math and previous classes, and the toys they played with when they were younger, for example. This helps both the student and the teacher understand where the student is when it comes to math. Whether the student enjoys this subject or fears it, using a mathematics autobiography will help put different issues in perspective. Also, it combines math with literacy (writing) and helps students see how their studies connect.

► Simon Says Geometry

Many students tune out when they spend too much time sitting in class. It is important to get students out of their seats and moving to get them thinking. “It doesn’t matter if a teacher is clear or concise if the students aren’t with him or her,” said Feldman. *Simon Says Geometry* is a fun movement-based activity that gets students using and listening to mathematics terminology. It allows teachers to combine visual, kinesthetic, and audio learning techniques.

These are basic geometric terms, with corresponding body positions, that can be used to play *Simon Says Geometry*:

- Point = Fist
- Segment = Arm bent at elbow across chest
- Ray = Arm straight across
- Line = Both arms extended (right arm to right side, left arm to left side)
- Perpendicular = One arm up, one to the side
- Parallel = Both arms up

Simon Says Geometry is played the same way as the conventional Simon Says game, except the leader uses math terms. A simple game might look like this: “Simon Says *Point*” (students make a fist to demonstrate a point); “Simon Says *Perpendicular*” (students extend one arm toward the ceiling and one arm to their side); “Simon Says *Line*” (students extend both arms to represent a line); “*Ray*.” Whoever makes the *Ray* is out because the leader didn’t say “Simon Says.”

► Tell stories to help students remember math concepts.

When teaching students how to get square roots, for example, Feldman tells the following silly story:

SAMPLE:

1) $\sqrt{12}$

2) $\sqrt{4 * 3}$

3) $\sqrt{2 * 2 * 3}$

4) $\sqrt{2 * 2 * 3}$

5) $2\sqrt{3}$

“This number 12 is in the ‘radical’ house. It’s in the ‘radical’ jail. Number 12 really wants to get out of jail. To get out of jail, numbers need to meet certain requirements. First and foremost, they need a buddy, but not just any buddy. The buddy must be just like them. Take number 12 and break it down.” (Feldman factors the number 12 to get $2 \times 2 \times 3$. She then circles the two buddies.) *“Now, something weird happens when the buddies leave the gate. They get zapped and they fuse together!”* (Feldman makes a buzzing sound as she moves the two number two’s out of the jail. They get “fused” together, resulting in the number two. See step #5). *“Number 3 does not have a buddy, so it has to stay in jail.”*

► Let students make their own discoveries.

Wait time is very important! Most teachers do try to select different students to answer questions out loud. After posing a math problem to the class, educators should also make certain to give students ample time to solve the problem. Some students will get the answer immediately. If the teacher calls on those students too quickly, the students needing more time to get the answer will just give up. They will have no incentive to solve the problem on their own. When teachers expand the “wait time” they see more students’ faces “light up” with understanding.

► Illustrate connections between mathematics and daily life.

Math teachers have said they often hear students ask, “When am I going to use this?” Educators should explain to students the importance of knowing percents, fractions, and geometry. With almost every single math concept, there is a real-life dilemma that can be solved by applying the concept, for example, tipping at a diner or figuring out how to lay down carpet. These are activities that students may someday need to do.

*Materials were provided to the Title I Dissemination Project, Inc. by the Massachusetts Elementary School Principals’ Association (MESPA) and were created by Deborah Feldman, MESPA Mathematics Consultant. Permission has been granted to use this tip sheet to assist educators with strategies and effective practices in their schools, but should not be included in a formal presentation or workshop. The “Math Strategies for Middle-School Educators” training was sponsored by the Title I Dissemination Project, Inc.



► **Create silly songs to help students retain concepts.**

Many elementary educators hold students' attention by being theatrical, but this often changes in middle school. Feldman recommends middle-school teachers use humor, singing, and drama when teaching. Feldman has written songs for her middle-school students to sing and has found this to be effective in helping students retain math concepts. This song helps students remember when two triangles are congruent.

TRIANGLE CONGRUENCE SONG (Set to Louis Louis)

KEY:

SAS = Side, Angle, Side

SSS = Side, Side, Side

HL = Hypotenuse, Leg

AAS = Angle, Angle, Side

ASA = Angle, Side, Angle

Chorus: SAS HL ASA SSS AAS (repeated)

*Congruent triangles are what I'm after
I want a shortcut that'll give me laughter
But I don't want to do too much work
And I want to get it right so I don't look like a jerk
So I look for three facts about the triangles I see
I try to match 'em up so it looks good to me*

Chorus...

*First I look to see what I am given
It makes my life easy, that's why I'm livin'
I look to see if the tick marks are there
To let me know some parts match up – that's all I care
Then if there are the right three parts
I've got the answer right from the start*

Chorus...

*But sometimes I've got to use my brain
I know that seems like an awful strain
I've got to look for things like bisectors and midpoints
Like altitudes and vertical angles, if you can get my point
Cause I really need three parts that make a pattern
So I can say congruent is all that is matterin'*

Chorus...

*Sometimes I have to look really closely
Use what I know 'bout parallels cause that can be ghostly
But the ones I hate most of all
Are the ones that overlap – they're so hard to call
I look for reflexive parts to say that they match up
Then use what else I know to patch it up*

Chorus...

*So now that I've told you 'bout all of that
I've got to give you warning 'bout the ones that are bad
You can't use AAA although it might look familiar
It only gives two triangles that have to be similar
And you can't use ASS because two triangles are formed
And you don't want to be one, now you have been warned*

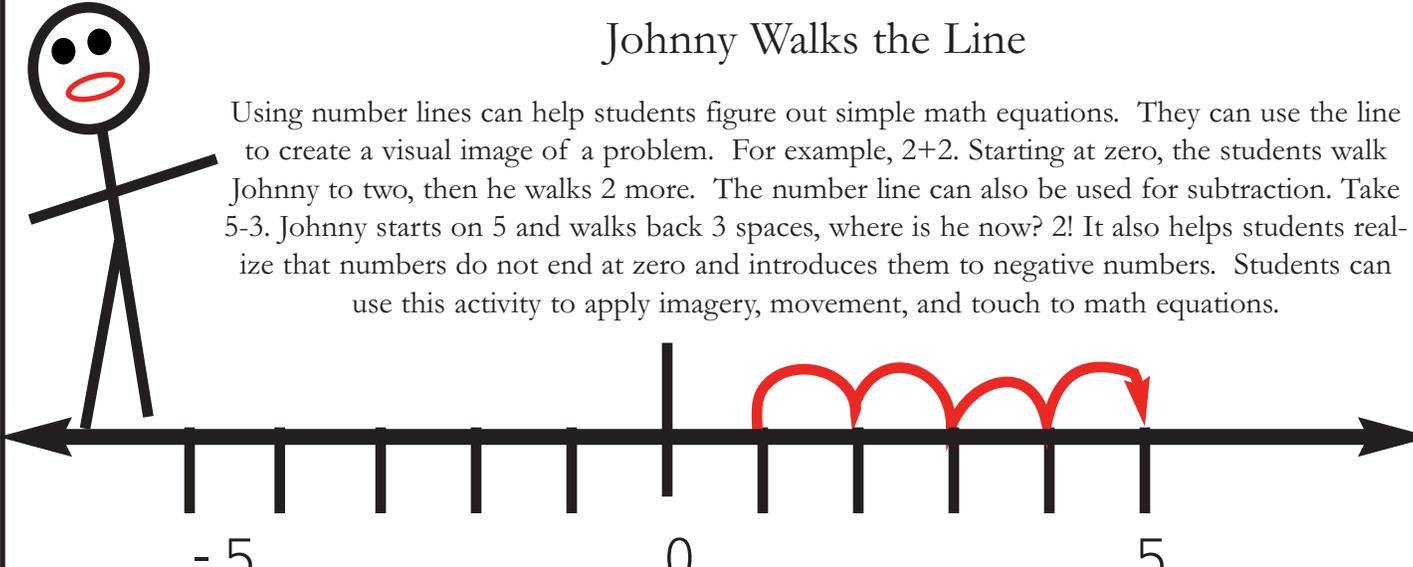
Chorus...

► **Active Learning - Think, Pair, and Share**

When teachers ask the class a question, they should give students time to think about the answer, then partner them up to discuss how they got the answer. This should not be a time-consuming event, but a quick way for the students to learn from each other different ways to solve problems.

► **Allow students to see and touch something physical, such as a manipulative, when solving problems.**

This strategy gives students something to remember when thinking back on problems and solutions. Teaching with manipulatives is helpful and can help even the most challenged student succeed; however, when manipulatives are no longer needed and understanding of the problem is improved, manipulatives can act as a crutch and confuse the student.



Johnny Walks the Line

Using number lines can help students figure out simple math equations. They can use the line to create a visual image of a problem. For example, $2+2$. Starting at zero, the students walk Johnny to two, then he walks 2 more. The number line can also be used for subtraction. Take $5-3$. Johnny starts on 5 and walks back 3 spaces, where is he now? 2! It also helps students realize that numbers do not end at zero and introduces them to negative numbers. Students can use this activity to apply imagery, movement, and touch to math equations.