Law and Algebra: SVU (Special Visual Unit)

Presenter: Heidi Schuler-Jones

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All of today’s handouts, resources, and PowerPoints can be found on the following Google Drive. Note: You do not need a Google email or Google Drive to access the folder. https://goo.gl/HuP5JG
Greetings from Georgia!

► Who am I?
  ► Heidi Schuler-Jones
  ► LINCS National Trainer
  ► Professional Development Specialist for TERC
  ► Former full-time GED instructor in Georgia (10 years)
  ► Avid reader of mystery and detective novels

► What do I do for a living?
  ► Conduct trainings and workshops across the U.S.
  ► Write math curriculum

► When did I get started in Adult Education?
  ► I was first introduced to AE in November 2006, and I’ve been in education ever since despite my long-time belief that I would never be a teacher.
    ► (This is what happens when both of your parents are school teachers.)
  ► Came into teaching by chance (they needed a teacher; I needed a job) and am humbled by the individuals in my workshops and classroom each and every day.
Greetings from Georgia!

**Why** did I name this workshop *Law and Algebra: SVU (Special Visual Unit)*?
- I wanted the title to be memorable and to stand out in the midst of all the workshops you’d attend this week.
- It represented what I think we’ve been missing in our approach to algebra (visuals).
- I’m a HUGE fan of the TV show that inspired this workshop’s naming.

**How** will you use this information when you return to your classroom?
- Handouts will be shared electronically through the MAEA website; also feel free to email me if you need something
- Resource list is provided at the end of this PowerPoint
- Hands-on activities you’ll be doing can be reproduced easily with minimal prep work
- Take pictures of you and your colleagues in action to remember what you did and to share with your students (visual aid and reminder to them that teachers take classes, too).
What we’ll be doing for the next 2 hours

- Algebra: The “A-Word” in math class (where did it all go wrong and why)
- Finding algebraic patterns in the real world
  - Visual → Real World → Symbolic Notation
- Practicing real world algebra (partnered work)
- Seeing the pieces come together (group activity)
- Concluding thoughts, resources for your classroom, Q & A
- All of today’s handouts, resources, and PowerPoints can be found on the following Google Drive. Note: You do not need a Google email or Google Drive to access the folder. 
  https://goo.gl/HuP5JG
Algebra: The “A-Word” in Math Class

- Taking OUR algebraic temperature
- Taking our STUDENTS’ algebraic temperature
  - Research shows that mathematical proficiency also includes having a productive disposition. Attitude is everything.

And then Satan said: PUT THE ALPHABET IN MATH
Algebraic reasoning in elementary school

Here’s a 2nd grade algebra problem:

Put boxes in the empty pan.
Make the pans balance.
Which boxes will you use?
Can you use a different set of boxes? Explain.

What’s encouraged: exploration, investigation, hands-on learning, trial and error, explanation and reasoning
Algebraic reasoning for our adult learners

Most of our students have available to them either at home or in our classrooms the following algebra resources:

- Videos demonstrating the steps to solve problems (Khan Academy, Algebra2go)
- Worksheets or books with drill problems and similar solution steps demonstrated

Solve the equation.

\[-3(x + 4) - 5 = -(2 - x)\]

What’s encouraged: repetition, solving problems according to a systematic approach that has been demonstrated vs discovered, process vs concept
These resources work, but what would make them better?
Solving the Math Problem (a kid’s perspective)

- This video from Dr. Jo Boaler’s Youcubed Summer Camp describes the power of mindset math in students’ own words! These inspiring clips came from kids whose math beliefs and achievement were transformed after just 18 days of lessons with youcubed.

- [https://www.youcubed.org/solving-math-problem/](https://www.youcubed.org/solving-math-problem/)

Solving The Math Problem
Keeping it real allows us to explore the various ways of seeing and solving the math.
Patterning with stick figures

(From Seeking Patterns, Building Rules: Algebraic Thinking [EMPower series]. Teacher book, p. 203.)
College Savings

- One of your newest students shares that he has decided to start saving now for college. He doesn’t make much money, but he figures that he needs to save 25 cents out of every dollar he earns. He has created a small chart to help him get started.

- He comes to you with his most recent pay stub in hand. It shows that he earned $80 last week.

- Jot down some things you could show him so he’ll know what to put aside in his savings.

<table>
<thead>
<tr>
<th>Earned (E)</th>
<th>Saved (S)</th>
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<tbody>
<tr>
<td>$1.00</td>
<td>$0.25</td>
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<td>$2.00</td>
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<td>$3.00</td>
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<td>$4.00</td>
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Some Possible Responses

- **Rule in Words**
  - To get the amount saved ($S$), multiply the amount earned ($E$) by .25

- **Equation** $y = 0.25x$ (or in context: $S = 0.25E$)
  - We’re using the slope-intercept form ($y = mx + b$)

- **Table of Data**
  - Note the use of patterns to make the values easier to find or calculate (added the first four entries to find the value for $10$ earned and then doubled each subsequent entry to get to $80$ earned)

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<tr>
<td>$80.00$</td>
<td>$20.00$</td>
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- **Graph**
  - y-intercept: shows us (visually) where the rate of change begins to take shape; also reminds us of what is (or is not) at the end of the equation
  - slope: helps to connect the “rise over run” model, especially to fractions and decimals; also connects the slope as the multiplier (mover) in the equation
College Savings (Graphed)

\[ y = 0.25x + 0 \]

**y-intercept**

\[ y = \frac{1}{4} x + 0 \]

**y-intercept**

**slope**
College Savings (Graphed)

\[ y = 0.25x \]

\[ y = \frac{5}{20} x \]

same slope
Did we see examples of these in our solutions?

(From Seeking Patterns, Building Rules: Algebraic Thinking [EMPower series]. Teacher book, p. xxi.)
4-Part Harmony

- We will spend the rest of our time together working on the skills we just saw with the previous example about the student needing to save money for college. In each of the problems you’ll do today, keep in mind the 4-part harmony we just explored and how each lends itself to deeper understanding:

  - **Rule in Words**
    - To get the amount saved \( (S) \), multiply the amount earned \( (E) \) by 0.25
  - **Equation** \( y = 0.25x \) (or in context: \( S = 0.25E \))
  - **Table of Data**
  - **Graph**
    - y-intercept
    - slope

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Practicing Real World Algebra

- Take a look at the “Algebra in Our World” packet.
  - We will do the first problem together.
  - Find a partner at your table to do some of the other problems in the packet.
  - There are a couple of “challenge” problems at the end where you are given the equation and asked to create a real world story problem to match it.
Reflecting on the “Algebra in Our World” activity

- How does this approach differ from the traditional ways we teach these topics?

- What are some things we could do to this activity to make it more interesting for our students?
You’ll find on your table a graphing practice packet (and answer key).

This is a packet I created for my students to use in class and for reference at home.

It’s designed as a teaching tool, as well as a resource for those needing a bit more practice with graphing.

It’s also a nice tie-in to the next activity we’ll be doing as a group.
Seeing the pieces come together

- Get into groups of 4 or 5 for this next activity.
- You will be rotating around the room in your groups to visit as many of the algebra stations as you can in the time allotted for this activity.
- Your group will need to take a stack of sticky notes and a pen or pencil with you to each station.
- When you reach a station, take note of what information has been provided either by me or by a previous group. Look for anything not answered or completed.
- With your group, determine the missing information and record it on your sticky note.
- Place the sticky note on the correct section on the chart paper.
- Move to a new station with a new problem and start the process again.
Reflecting on the Algebra Stations activity

- What did you like most about this activity?
- What did you like least about this activity?
- How could you use this in your classroom?
Concluding thoughts, resources for your classroom, Q & A

- You’ll find on the next few slides the following resources:
  - List of similar activities to what we did today and where to find them
  - List of free resources mentioned in today’s presentation
    - Note: The PowerPoint for today also has hyperlinks embedded on these items.
- All of today’s handouts, resources, and PowerPoints can be found on the following Google Drive. Note: You do not need a Google email or Google Drive to access the folder. [https://goo.gl/HuP5JG](https://goo.gl/HuP5JG)
- Note: You are free to remix, tweak, and build upon my work non-commercially, as long as you credit me for the original work and license your new creations under the identical terms. [CC BY-NC-SA](https://creativecommons.org/licenses/by-nc-sa/4.0/)
- You’ll also find at your table (and again online) the Open Educational Resources (OER) Fact Sheet.
- Any questions or comments not already addressed?
Heidi’s Resource Recommendations

- **EMPower Math Series** - This 7-book series is one of the BEST adult education resources around! It was researched and written by adult ed folks for adult ed students and teachers. It has lesson plans, homework, and quizzes already designed for your use. You will need the Teacher Edition and Student Edition for each book. The best part is that the Student Edition comes with a copyright disclaimer granting you permission to reproduce the pages for students in your classes!  

  [contact your McGraw-Hill rep for pricing]

- **Seeking Patterns, Building Rules** is where you’ll find similar activities to those we did today. Here are some of my favorites:
  
  - Lesson 1: Guess My Rule  (GREAT activity for patterning with in-out tables!)
  - Lesson 2: Banquet Table  (Hands-on activity that really helps to emphasize the purpose of the y-intercept in a contextualized way.)
  - Lesson 6: Circle Patterns  (AWESOME way to have students connect all those measurement formulas back to algebra, and see the relationship between circumference, diameter, and $\pi$.)
  - Lesson 7: What Is the Message?  (Fun activity that connects the equation to a rule in words and graph.)
  - Lesson 8: Jobs Offers  (Highly effective way for students to see how to use algebra when making important decisions.)
  - Lesson 9: Phone Plans  (My students LOVE this activity! It really makes them see how/where algebra is used in the real world and gives them a chance to see how much their algebraic reasoning and skills have grown throughout the course.)
Heidi’s FREE Resource Recommendations

- [www.OERCommons.org](http://www.OERCommons.org) - excellent resource for finding high quality math-specific Open Educational Resources
- [http://map.mathshell.org](http://map.mathshell.org) - Mathematics Assessment Project includes lessons, hands-on activities, LOTS of exploration, discovery, discussion
- [http://blog.mrmeyer.com/about-2/](http://blog.mrmeyer.com/about-2/) - Dan Meyer’s Three-Act Math videos and lessons are a fantastic way to get students engaged as problem-solvers
- [http://sabes.org/content/cuny-hse-curriculum-framework](http://sabes.org/content/cuny-hse-curriculum-framework) - The CUNY HSE Curriculum Framework (Section 4 - functions & algebra); written for AE
- [www.ck12.org](http://www.ck12.org) - contains lesson plans, interactive elements, practice, and a student or teacher platform
- [https://phet.colorado.edu/](https://phet.colorado.edu/) - interactive simulations for science and math
- [www.mathplayground.com](http://www.mathplayground.com) - games, manipulatives, activities for most math topics; great function machine manipulative for in/out tables and slope-intercept form equations
Want to stay connected with other math-minded people? Then join the Adult Numeracy Network - ANN!

- We are a community dedicated to quality mathematics instruction at the adult level.
- We support each other, we encourage collaboration and leadership, and we influence policy and practice in adult math instruction.
ANN will sponsor two practitioner research projects to begin this fall and conclude before our annual meeting next spring. We would like practitioners to familiarize themselves with the ANN Teaching and Learning Principles and the Components of Numeracy and base their research project on some aspect of these two important documents. Selection of projects will be based on how well the practitioner follows the four components for practitioner research listed below and utilizes an idea(s) from the Teaching and Learning Principles.

Four Components of Practitioner Research:

- Identify the question to be researched.
- Discuss how you will collect data to answer the question.
- Analyze and interpret the data.
- Share the findings.

Each year, the deadline for submission is October 31. Two practitioners will be selected and will receive a $500 stipend at the completion of their projects and sharing of their findings. Selected practitioners will be asked to join ANN if they are not already members.

Visit the ANN website for more information and to view Sample Projects.
Join us online at
AdultNumeracyNetwork.org
and
at the 24th Annual ANN Gathering
@ COABE Preconference
Sunday, March 25, 2018
Phoenix, AZ