Arguing Constructively in Math Class
Goals:

1. Participants experience the Sharing Skepticism routine.
2. Participants can explain how the routine supports mathematical argumentation.
Instructional routines are routinized “designs for interaction that organize classroom instruction”.

(Magdalene Lampert, NCSM, 2013)
Instructional routines embed instructional strategies

- Supports for ALL learners
- Instructional routines
- Repeated uses of routines
Cognitive focus in the classroom

*Without* instructional routines…

- Students
- Mathematics
- Assessment
- Classroom Procedures
- Social Concerns
- What am I supposed to do next?
Cognitive focus in the classroom

Without instructional routines…

With instructional routines…
Without instructional routines...
Conversations about teaching

*Without* instructional routines...

*With* instructional routines...
Sharing Skepticism

**WHAT:** To connect visual and algebraic expressions.

**WHY:** To "argue like a mathematician", to construct and critique arguments.
Sharing Skepticism

**WHAT:** To connect visual and algebraic expressions.

**WHY:** To 'argue like a mathematician', to construct and critique arguments.

**THINK like a student**

**SPEAK like a student**

Consider the routine
Sharing Skepticism

**WHAT:** To connect visual and algebraic expressions.

**WHY:** To "argue like a mathematician", to construct and critique arguments.

THINK like a student

SPEAK like a student

Consider the routine
Sharing Skepticism

**WHAT:** To connect visual and algebraic expressions.

**WHY:** To “argue like a mathematician”, to construct and critique arguments.
Sharing Skepticism

1. Solve a problem
2. Discuss Arguments
3. Share and Critique Arguments
4. Choose an Argument
5. Reflect on Learning
Solve a Problem

Ask yourself…

How can I make my process and reasoning as clear and convincing to others?
Solve a Problem

Ask yourself…
How can I make my process and reasoning as clear and convincing to others?

Which visual goes with which expression?

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th></th>
<th>B</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>3(x + 6)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>3(x + 2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>3x + 2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Solve a Problem

Ask yourself…
How can I make my process and reasoning as clear and convincing to others?

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td></td>
<td>3(x + 6)</td>
<td>3(x + 2)</td>
<td>3x + 2</td>
</tr>
<tr>
<td>B</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Which visual goes with which expression?

http://davidwees.com/m/nctmtask
<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>3(x + 6)</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>3(x + 2)</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>3x + 2</td>
</tr>
</tbody>
</table>

Source: [http://curriculum.newvisions.org/math](http://curriculum.newvisions.org/math)
Discuss Arguments

“I think... because...”
“This works because...”

“How do you know...?”
“Can you help me understand...?”
Share Arguments

“We think... because...”
“This works because...”

“They think... because...”
“Their argument works because...”
“We wonder about ... because ...”
Share Arguments

“We think... because...”
“This works because...”

“They think... because...”
“Their argument works because...”
“We wonder about ... because ...”
Choose an Argument

THINK

Ask yourself…

Which of these arguments convinces me and why?
Choose an Argument

Argument 1

Argument 2
Choose an Argument

Argument 1

3(x + 2)

1

2

3

Argument 2

3(x + 2) = 3x + 6
Choose an Argument

PAIR

Decide together on argument you both agree with and be prepared to explain your reasoning.

Ask yourselves: Can we improve the argument?
Choose an Argument

Ask yourselves: Can we improve the argument?

Argument 1

3(x + 2)

1

2

3

Argument 2

3(x + 2) = 3x + 6
Choose an Argument

“We found … convincing because …”

“We understood … better because …”

“We can improve … by …”
Choose an Argument

Ask yourselves: Can we improve the argument?

Argument 1

Argument 2
Choose an Argument

Ask yourselves: Can we improve the argument?

Argument 1

\[ 3(x + 2) \]

Argument 2

\[ 3(x + 2) = 3x + 6 \]
Choose an Argument

Ask yourselves: Can we improve the argument?

Argument 1

\[3(x + 2)\]

Argument 2

\[3(x + 2) = 3x + 6\]
Reflect on Learning

When *constructing* arguments it is important to … because …

When *critiquing* arguments it is important to … because …
END of Activity

Consider Instructional Practices
Share in the chat window:

- What do you think stays the same each time this routine is used?
- What do you think changes?
How does this routine support mathematical argumentation?
Conjecturing

- Constructing cases
  - Constructing, organizing, observing (individual, group, and whole class), search for patterns

- Formulating conjectures
  - Check the correctness based on the existing cases

- Validating the conjectures
  - Validating the conjectures with new cases not for all

- Generalizing
  - Generalizing the conjectures for all cases

- Justifying the generalization
  - To prove with the modes of argumentation of the generalization

Argumentation

- Data
- Warrants
- Rebuttals
- Claims
- Backings
- Qualified
- Conclusions

Source: http://davidwees.com/m/nctmimage
Questions about the routine
Sharing Skepticism is adapted from:

Routines for Reasoning
Grace Kelemanik, Amy Lucenta, Susan Janssen Creighton
Available at Amazon
Heinemann
Dedicated to Teachers

The Nueva School
More Resources and Acknowledgements
Contact Information & Slides

Blog: https://davidwees.com

Twitter: @davidwees

Email: davidwees@gmail.com

Template Slides: http://davidwees.com/m/nctm2020slides
Handout: http://davidwees.com/m/nctm2020handout
References: http://davidwees.com/m/citations