**Goals of activity**: The goals of this activity are to expand the ideas of coherence to include connecting ideas across topics usually treated separately (like geometry and algebra) and to include the idea of ***logical necessity***. This activity also incorporates the idea of inquiry into finding and developing an idea with coherence. Teachers heighten their awareness of coherence and finding coherence in the CCSS, and also start thinking about the inquiry mode of planning.

**Mathematical/SMP goal**:

*Understand why the slopes of perpendicular lines are opposite reciprocals.*

Construct viable arguments and critique the reasoning of others.

Look for and make use of structure.

Use appropriate tools strategically.

**Pedagogical Content Knowledge**: Teachers understand the difference between perception-based and conception-based instruction, and brainstorm ideas for improving coherence in their teaching.

**Materials:**.Copies of **Rotating Triangles and Lines** (one per person); Posters withmeanings of coherence on them posted around the room (optional)

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| **Expanding our understanding of Coherence:**  Think to yourself:  How do you currently understand coherence?  How do you use your understanding to teach for coherence? |  |
| Meanings of coherence from previous workshops and CCSS documents will be posted around the room. PLCs should choose three of the meanings and write an example of how they can incorporate this meaning of coherence into their teaching practices.  **Logically connected**: Organize units by ideas rather than topics  **Meaningful**: “the coherence of a curriculum (intended, implemented, or experienced) depends upon the fit of meanings developed in it” (Thompson, 2008, p.32)  **Built through prior knowledge:** Advance students’ prior knowledge by challenging their current conceptions**.**  **Progressions:** Dig into the standards to see how current ideas build from previous standards and across years.  **Learning trajectories:** Look for how ideas change and grow over a unit and over the school year.  **Connections between concepts and procedures:** Developing procedures conceptually, and using procedures to support conceptual understanding  **Makes sense**:  Students can justify statements and conclusions mathematically. |  |
| Suppose you want students to be able to find the equation of a line through a point that is perpendicular to a given line.  What would it mean to teach this with coherence?  **Take notes as you discuss**:  Generate specific ideas for lessons that would support coherent learning of this goal. (Consider these as hypotheses about what you think would affect student learning of this goal.)  Explain why you think your ideas would support coherent learning. | Note that this is a **lesson-level goal**, and the key question is a question I ask myself and discuss with my colleagues.  Have them discuss this in their groups.  Talk about these as ***hypotheses***, but that we won’t know until we use the lesson.  It is more important to discuss each idea that surfaces rather than to settle on one idea.  Whole group sharing, focusing on types of reasoning. |
| Reflect on the content of your discussion:  What types of reasoning did you use to support your ideas?  What reasoning did you use about the mathematics?  What reasoning did you use about students?  What reasoning did you use about how students develop ideas?  What reasoning did you use about coherence? | Whole group sharing:  Note that the level of conversation here is very important.  Talk about these as ***hypotheses***, but that we won’t know until we use the lesson. |
| Given your ideas for teaching this goal, what you would look for during the lesson as evidence of whether or not students learned with coherence?  How is the evidence connected to your justifications?  That is, how will the evidence either support or refute your hypotheses? | Whole group sharing:  How is the evidence connected to your justifications? |
| An example: One group comes up with the following task, and hypothesizes that they can build on students’ prior knowledge of 8.G.1, although they believe they also need to help students recall what they know about 8.G.1. They have anticipated about four different ways that students may solve this.  Do the task, anticipating as many ways as you can that students might do it. | Distribute the task: **Rotating triangles and lines.** |
| What evidence can we find in the different solutions of student thinking in the ways we hypothesized? In ways we did not hypothesize?  In what ways did the task target learning with coherence? | Whole group sharing of solutions.   * (3,2) is transformed to (-2,3) by 90 degree rotation around the origin. Why? OR * To which point does (3,2) is transformed by 90 degree rotation around the origin?   Whole group discussion should include:  More than one way to reason that the angle is 90 degrees, and reasoning that supports the general rule; for example: Complementary angles are in the 7th grade CCSS, and two angles of a right triangle are complementary.  Goal was Logical Necessity: |
| How would you revise the task to improve it? Discuss *reasons* for your suggestions.  How would you implement your revised task to support the goals of the lesson? |  |
| Reflection: Give one example of a way you can use the ideas just presented to increase students’ coherent learning in what you are currently teaching. |  |