An informed understanding of learning progressions can lead to more productive discussions about student work.

Jennifer L. Kobrin and Nicole Panorkou

Student work is the currency of the classroom. Every day, students in classes around the world produce massive amounts of work in the form of written assignments, projects, worksheets, and other products. But how can educators unlock the power of this rich source of data? How can we move the purpose of student work from proving mastery to improving learning? (Deuel, Nelson, Slavit, & Kennedy, 2009). Consider the following scenario of a traditional approach to looking at student work.

A team of 3rd grade teachers discusses student work produced during a math lesson about measuring area. In the activity, students were asked to compare the area of two rectangular robot heads and decide which one covered more area. The teachers talk about one student's response (see fig. 1). This student used a ruler to measure the height of the two heads and said, “The first one is two inches, and the second one is three inches, so the second one is bigger.”

Jane facilitates the discussion about the student’s work with three other teachers.

Jane: What do you notice about this student’s work?

Alice: The student only measured the heights of the two heads.

Robert: I noticed that the student knows how to use a ruler correctly, but he doesn’t seem to understand the concept of area.

Rosa: It was interesting that the student said the second head was “bigger” and didn’t use the word “area.”

Jane: What do you think this student was thinking about?

Robert: The student doesn’t seem to understand that to compute area, you need to measure both the length and width of the shape and then multiply.

Rosa: This student might not even know what “area” means.

Jane: What would you do next in your instruction?

Alice: I would review the concept of area and emphasize that it is the amount of space inside of the shape. Comparing only the heights of the two shapes doesn’t give you a comparison of the area.

This dialogue is consistent with the kinds of responses offered in formative
assessment protocols. Although the teachers use the student's work to broadly identify what he knows and what feedback they can provide, this discussion is still hovering above the precise analysis needed to guide productive decisions about teaching and learning.

**Incremental Learning**

Learning progressions are a valuable tool that teachers can use to go beyond the traditional approach and unlock the potential of student work. Also referred to as “learning trajectories” in mathematics, learning progressions are described as “a carefully sequenced set of building blocks that students must master en route to mastering a more distant curricular aim. These building blocks consist of subskills and bodies of enabling knowledge” (Popham, 2007, p. 83).

A key idea behind learning progressions is that they are informed by research on how students learn and how students’ thinking develops over time as a result of instruction. Learning progressions are distinct from educational standards; progressions describe the typical ways students think about a topic, whereas standards are aspirational statements based on expert consensus about what students should know and be able to do. Another common feature of learning progressions is that they describe the stages or levels students move through as their understanding develops, the kinds of tasks that students can perform at each level, and what that performance looks like (Heritage, 2013).

Learning progressions are ideal for interpreting student work. Although existing protocols on looking at student work engage teachers in reflection about what the work reveals about students’ thinking, learning progressions can help teachers identify student work that illustrates different levels of developing expertise. In doing so, teachers can place student work along that continuum.

In 2014–2015, we worked with 22 3rd grade teachers in the United States and Australia as part of a research study to evaluate the insights that a learning progression provides about students. Specifically, we examined how familiarity with a learning progression increased teachers’ ability to find evidence of students’ level of thinking, and whether that knowledge helped teachers plan more targeted and personalized instruction.

The teachers participated in professional development (PD) that introduced them to a learning progression about area measurement and engaged them in several activities designed to interpret student work using the progression. Six teachers participated in 20 hours of face-to-face PD at their school, and the remaining 16 participated in online PD modules. Our results were quite promising. We found that the learning progression not only served as a useful framework for examining student work, but it also increased teachers’ content and pedagogical knowledge for teaching area measurement. Here, we share an example from our project to illustrate how the learning progression can help teachers interpret student work.

**Measures of Student Understanding**

Geometric measurement of area is usually defined as covering or filling space and then quantifying that covering. As students develop area measurement skills over time, they typically display several misconceptions. For example, when students work on tasks that require them to cover space to measure area, they often leave gaps between units, overlap them, double count them, or combine units of different size (Clements, Sarama, & Battista, 1998; Lehrer, 2003). Moreover, it is often difficult to advance students from the strategy of counting or adding individual tiles in a figure to the more sophisticated strategy of using the row-and-column structure of a shape to compute area. The latter strategy leads to a conceptual understanding of the area.
The animal expert says: We need to design a new yard for the hippopotamus. This is a very large animal that needs a lot of space. We have two shapes to choose from. Which one of the two shapes below do you think would give the hippo the most space? How do you know?

You may use any of these tools if you like. (A transparency with a dot grid, a pair of scissors, a ruler, and centimeter square tiles are provided.)

(Note: the dimensions of the shapes are shown, but were not presented to students.)

Thomas traces the square and rectangle on grid paper and says, “I’m gonna count which ones take up more space.” He counts each square on the grid that is covered by the square as shown here and says, “There are 25 spaces.” He does the same thing for the rectangle and says, “This one takes up 27 spaces.”

A Look Back at the First Task
Looking back at the initial task of measuring the area of robot heads, if the teachers became familiar with the
<table>
<thead>
<tr>
<th>Name of Stage</th>
<th>Description of Stage</th>
<th>Example of Student Behavior</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceptual coordination of attributes across figures</td>
<td>Student compares the areas of two shapes by direct comparison, without quantifying the numbers, either by placing side-by-side or superimposing one on top of the area.</td>
<td>“Shape B is bigger because it’s taller.”</td>
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<tr>
<td>Informal understanding of conservation of area</td>
<td>Student understands that the total area of a shape does not change if you turn or rotate it, or cut it into smaller pieces and rearrange it.</td>
<td>Student cuts Shape B in pieces and places them on top of Shape A to compare.</td>
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<tr>
<td>Using equal area units</td>
<td>In measuring area, student considers the size of the units.</td>
<td>A common misconception is that the student may use different size square tiles to cover and measure the shape.</td>
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<tr>
<td>Using area unit iteration</td>
<td>Student can fill in shapes with unit squares to measure area, without leaving gaps or overlapping the units.</td>
<td></td>
</tr>
<tr>
<td>Using area units to measure area</td>
<td>Student counts each individual unit square within a shape to measure its area.</td>
<td></td>
</tr>
<tr>
<td>Using area composites to measure area</td>
<td>Student counts the number of units in a row or column and then repeatedly adds that number to compute area.</td>
<td>4 units in a row, and there are 5 rows in the rectangle, so $4+4+4+4+4 = 20$ square units is the area.</td>
</tr>
<tr>
<td>Using multilevel area composites to measure area</td>
<td>Student counts the number of units in a row, then counts the number of units in a column, and then multiplies the two in order to compute area.</td>
<td>$5 \times 4 = 20$</td>
</tr>
<tr>
<td>Adopting formal formula for area</td>
<td>Student applies the formal area formula (length x width) appropriately and with minimal prompts or cues.</td>
<td>$5 \text{ cm.} \times 7 \text{ cm.} = 35 \text{ sq. cm}$</td>
</tr>
</tbody>
</table>
learning progression, their discussion of student work could be much more focused and informed, resulting in more concrete and targeted instructional suggestions.

JANE: What do you notice about this student's work?

ALICE: The student only measured the heights of the two heads.

ROBERT: The student knows how to use a ruler correctly, but he doesn't seem to understand that he needs to measure both height and width to compare area.

JANE: What do you think this student was thinking about?

ROBERT: The student seems to only consider height as a way to measure area. Isn't this a common misconception in the learning progression stage of "perceptual coordination of attributes across figures"?

ROSA: Well, we are not sure about that. In the task, the two heads look as if they have the same width. Maybe the student noticed this, and that's why he measured only the height.

ROBERT: True. We need to examine this student's thinking further with additional tasks.

JANE: What do you think you might do next in your instruction?

ROSA: I would give the student two shapes that have very different lengths and widths to determine whether he recognizes the two dimensions.

ALICE: I would try to rotate the shapes and ask him to measure again.

ROBERT: We could also ask him to cut the shapes and try to "fit" one into the other. That will help him to master the idea of "conservation of area."

Learner-Centered Practices

Our research shows that a learning progression can support teachers as they take a more fruitful look at student work and that they can use the insights gleaned as part of their ongoing formative assessment. In our project, teachers worked as a team to make meaning of the learning progression and to apply it to their daily practice. This approach is consistent with the idea of collaborative inquiry, which is critical for transforming teaching and improving student learning (Langer & Colton, 2005). And because the progressions are based on observations and insights from decades of research on students, learning progressions are naturally learner-centered. They take a developmental view to help teachers focus on individual students' learning over time and how they can assist that development.

Yet, despite recent attention to learning progressions as a potential tool to reform assessment and instruction, efforts to support teachers' use of these progressions are not prevalent. The barriers to widespread adoption include a lack of district resources to provide sustained professional development and misalignment of learning progressions with existing curriculum, assessments, and instructional materials. Close work with teachers as they are introduced to learning progressions and integrate them into practice is essential to fulfill their promise for helping teachers and ultimately students.

References


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