Transcript – Learning Progressions and the Diagnostic Assessments Part 1

Now, we are going to talk about learning progressions as the underlying foundation of a diagnostic assessment.

As students learn, the amount and complexity of their knowledge and skills in any domain start small and increase over time. That amount of growth varies with experiences and instruction but also seems to be a reflection of maturation, differences in ability, disposition, and interest. According to the National Research Council, learning progressions are descriptions of the successively more sophisticated ways of thinking about an idea as a student learns. A progression happens over a broad span of time, and while there is a path typically followed, all students do not follow the same path in the same way.

This graphic of a hexagonal map represents a possible learning progression.

As you look at this graphic, what do you notice?

This hexagonal diagram represents a learning progression that connects four different topics. Please note that there are no black lines between certain concepts to indicate possible relation and inter-dependence of these concepts. Hexagons separated by black lines are considered to be unrelated and independent. For example, according to the diagram, a student would hypothetically have to master concept 1.2 before being able to understand concept 1.3 or 2.1. The mastery of the concepts in level 2 and 3.1 are required before moving on to concept 4.1. However, a student does not have to master level 2 before moving on to level 3.

This hexagonal map shows increasingly sophisticated thinking, but more importantly, it also shows the interaction and integration of knowledge, which demonstrates that a students' learning and development of critical knowledge and skills may not necessarily be linear but may follow a number of different paths.

Concepts can be clustered around a single topic. Within level 1, the same relationship exists. Since there is no edge between 1.1 and 1.2, there is a connection between these concepts.

A learning progression is not unerringly accurate but represents best instructional thinking. A learning progression is not the one and only way, but a general path that we hypothesize students will take as they develop proficiency and understanding of new content and skills. Some may bring more or less prior knowledge or skills to the classroom, others may need instruction in smaller increments, and a few may learn in a different order.

According to the National Research Council, a learning progression has five essential elements.

1. **Target learning goals** -- Learning progressions require targets or clear end points defined by societal aspirations and analysis of the central concepts and themes of a discipline.

2. **Progress variables (e.g. core concepts) that are developed over time** -- Learning progressions require progress variables that identify the critical dimensions of understanding and skill that are being developed over time.

3. **Intermediate levels of achievement that progress toward mastery** -- Learning progressions need levels of achievement or stages of progress that define significant intermediate steps in the conceptual development that most children might be expected to pass through on the path to attaining the desired proficiency. Although it is not explicitly stated, we interpret this third element to say that it is important to also include an awareness of students' common misconceptions and errors. We will address this more in a later lesson.

4. **Learning performances at each level that articulate students' performance capability** -- Learning performances are operational definitions of what children's understanding and skills would look like at each of these stages of progress and provide the specifications for the development of assessments and activities which would locate where students are in their progress.

5. **Assessments that measure student development along the progression** -- Assessments are developed that measure and track student development along a learning progression.

The ESTAR and MSTAR Learning Progressions are based upon these essential elements. The first element, the target learning goal, is defined as the learning progression. The second element, progress variables, is defined as a learning progression level. The third element, intermediate levels of achievement, is defined as a level within the learning progression level. The fourth element, sublevels, is defined as learning performances at each level. The ESTAR and MSTAR Diagnostic Assessments measure student development along this progression. For the purpose of MSTAR, these four elements are used to assess two algebra-readiness concepts: Understanding Positive Rational Numbers and Variables, Expressions, and Equations.

Now, we will discuss the role of a diagnostic assessment within the RtI framework. This is a model used for RtI instruction with Tier 2 students.

Those students who are in Tier 2 are provided quality core instruction, increasingly intensive intervention support, and more frequent progress monitoring. The design of Tier 2 interventions should be based on the specific student's strengths and needs using data provided by the diagnostic assessment and other relevant tools.

Using specific decision rules, the teacher and instructional team can decide if the student is making adequate progress toward the instructional goals or is in need of more intensive support. The

Implementation Tools PD available in Project Share has important information about designing instruction to support students.

Transcript – Learning Progressions and the Diagnostic Assessments Part 2

Both the ESTAR and MSTAR Universal Screeners and the ESTAR and MSTAR Diagnostic Assessments focus on algebra-readiness skills and knowledge, but they have two different purposes.

The universal screeners are designed to make two instructional decisions. The first instructional decision is to identify students who may be at risk for not meeting our expectations in algebra and algebra-readiness skills. The second decision is to understand the intensity of support that those students need in order to be brought on track. It is administered to all students during a specified testing window in the fall, winter, and spring.

These two decisions can be made with support from other instructionally relevant tools after the fall administration. In addition to risk and intensity of support, the results of the winter and spring administrations should also be used to monitor students' progress toward end-of-year goals. Students might be identified as being at risk in the fall but after receiving targeted interventions are no longer considered at risk. For these students, we may want to reduce the intensity of their interventions. However, some students may not have been identified as being at risk in the fall, but as the material of the year has become more complex, they have started to demonstrate some risk for not meeting end-of-year goals. Therefore, winter and spring administrations may result in the reclassification of students into a different tier of support and/or providing a different level of intervention.

The diagnostic assessments are designed to help teachers identify why students are struggling with algebra-related content. The assessments will diagnose students' current level of understanding and persistent misconceptions with algebra-readiness content. They should be administered following the universal screeners in the fall, winter, and spring to students who are at risk in algebra-readiness skills (those students in Tier 2 or Tier 3).

This comprehensive assessment framework helps teachers not only identify students who are struggling but also provides insights into why they are struggling. It can also help both interventionists and teachers design supplemental instruction.

The development of the MSTAR Diagnostic Assessment began with the articulation of the MSTAR Learning Progressions which hypothesize the manner and order in which students develop specific algebra-related understanding over time. The content of the assessment is guided by two MSTAR Learning Progressions with items designed to target different levels of cognitive engagement. For more information on learning progressions, please work through the course on MSTAR Learning Progressions available on Project Share. The reports generated for teachers and school leaders after a student takes a diagnostic assessment will contain information about which learning progression sublevels were associated with the student's answer choices. This will help the teacher or interventionist understand

why the student is struggling with a particular concept and, in turn, provide a focus for individualized instruction.

The levels for the learning progression Understanding Positive Rational Numbers (RN) are labeled one through thirteen. Each of these levels has associated sublevels that are labeled and described in the MSTAR Learning Progression outline.

Recall the five essential elements from earlier in the course. Essential element three includes the intermediate levels of achievement that lead toward mastery, including misconceptions and errors. Element four includes learning performances at each level that articulate students' performance capability. Each of these elements is articulated for each level in the outline.

Take a moment to reflect on some of the concepts, misconceptions, and errors that relate to this learning progression.

Here is a visual of the learning progression; Understanding Variables, Expressions, and Equations (VE). Take a moment to reflect on the concepts, misconceptions, and errors assessed within this learning progression.

Items for the ESTAR and MSTAR Diagnostic Assessments were also designed to target different levels of cognitive engagement. Cognitive engagement refers to the level of cognitive processing through which students are expected to engage with the content. We use the taxonomy of cognitive engagement published by Kilpatrick, Swafford, and Findell (2001) from the National Research Council.

The strands include adaptive reasoning, strategic competence, conceptual understanding, productive disposition, and procedural fluency. It is vital to point out that all of the strands are interwoven and interdependent. Students' proficiency in mathematics is dependent on each of these strands. Weakness in one strand compromises the entire rope.

In order to get a true perspective of student proficiency within each diagnostic assessment, all of the strands are assessed, except for productive disposition. Productive disposition evaluates how a student perceives a math problem, which cannot be assessed using a multiple choice item format.

When students are administered the ESTAR or MSTAR Universal Screener, the results only communicate whether they got an answer right or wrong, not why they missed the question. However, when a student takes a diagnostic assessment, the results provide valuable information as to why he or she is struggling with a concept because the incorrect responses, or distractors, written for each item represent a misconception or error in student thinking from an earlier point in the learning progression. The results may, for example, help identify whether the student is making conceptual or procedural errors, using an inappropriate strategy to solve a problem, or struggling to reason abstractly.

Here is a sample item. This item would assess conceptual understanding of decimal place value because it is assessing the comprehension of the concept rather than using a procedure, strategy, or reasoning to answer the question. For example, to assess decimal place value procedurally, students could simply identify a decimal amount shown using a graphical representation.

We are able to understand students' thinking because each distractor is a plausible misconception or error a student may have with this concept. Take a look at each of the distractors for this sample item. Can you see some struggling students making these same errors? How would this information be valuable to you?

Here are some key notes about the diagnostic assessments. First, they require more items than screeners. More items must be included in the assessment in order to obtain reliable information about a student's consistent misconceptions and level of understanding.

Next, a diagnostic assessment should only be given to students who are at risk for not meeting expectations in algebra. If you have students who are on track for meeting those expectations, it would be inefficient to take instructional time to administer a diagnostic assessment.

Finally, the reports are designed to provide information about a student's specific areas of strength as well as opportunities for future instructional support. This information can be very helpful when designing intervention strategies, perhaps highlighting potentially limited background knowledge or specific misconceptions.