**How to Teach Mathematics and Make Adaptations Within a DBI Framework**



**Project STAIR**

**Mathematics Instruction Webinar:**

**Facilitator’s Guide**

November 2020

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Mathematics Instruction Webinar: Facilitator’s Guide

A: Overarching Goal

This session is designed to provide participants with an understanding of mathematical instructional strategies and best practices to implement within the data-based individualization (DBI) model to support algebra readiness in the middle school classroom.

B: Key Understandings

Participants will have a working understanding of how to teach and adapt mathematics strategies to support students to develop algebra readiness.

C: Session Objectives

* Understand how to implement instructional strategies including explicit instruction and the use of multiple representations.
* Understand how to adapt mathematical interventions.
* Understand key components of implementing instruction in the virtual environment.

Session at a glance

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| TIMING  | ACTIVITY  | DESCRIPTION  |
| :00 | Introduction and Overview  | Dr. Sarah Powell (University of Texas at Austin) will give an overview of the project describing the goals of project STAIR and its use of DBI.  |
| :05 | Explicit Instruction & Multiple Representation  | Samantha Bos (University of Missouri) will give an in-depth description of explicit instruction and multiple representations and how to implement both strategies in the classroom.  |
| :25 | Adaptations to Instruction  | Rachel Juergensen (University of Missouri) will focus on ways to adapt instruction to intensify intervention strength.  |
| :45 | Strategies for the Virtual Learner  | Rachel Juergensen (University of Missouri) will discuss some of the main components to consider when teaching mathematics in a remote learning environment.  |

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| Introduction and Overview 5 min | \*prior to session, disseminate infographic to participants Attendees will be welcomed to the session. The purpose of the session will be stated. There will be a recap of the specifics of the project. There will be a review of the Data Based Individualization (DBI) model: The key pillars of the professional development will provide teachers tools to enhance the students’ algebraic readiness. The tools include explicit instruction; utilizing problem solving structures; visual representation and fluency building on math; and assessment procedures that include screening, diagnostic assessment, and progress monitoring. The instructional platform will be discussed during this section.  |
| Instructional Platform 20 min | There will be a specific description of explicit instruction including core components of modeling, practice, and supports. Examples will be provided for each component. There will be a description of the explicit instruction essential components handout, which teachers can use to reflect on their practice. Participants will be invited to pause and consider if their lessons include elements of explicit instruction. A completed explicit instruction essential components handout will be discussed to highlight models for thoughtful teaching. There will be a description of the components of multiple representations, including examples for concrete, pictorial, and abstract representations. There will be a brief description of the multiple representation essential components handout, which teachers can use to reflect on their practice. Participants will be invited to pause and consider if their lessons include multiple representations. Participants will be led in a discussion regarding logistical concerns for implementing explicit instruction or multiple representations.  |
| Adaptations to Instruction20 min | Specifics of adaptations to interventions will be described. Examples and logistical concerns will be addressed for each of the 6 adaptations, including (a) implement with greater fidelity, (b) embed behavioral supports, (c) increase dosage, (d) adapt mathematics content, (e) utilize explicit instruction, and (f) explicitly teach transfer.  |
| The virtual environment 5 min | A description for ways to adapt explicit instruction and multiple representations in remote learning will be addressed. A brief call to action will be provided to wrap up the presentation. The session will end by opening the floor to questions.  |

**Handouts**

**Project STAIR: Explicit Instruction Essential Components**

Mathematical concept:

**MODELING**

1. What are my **goals** for this lesson?
2. What **vocabulary** and **skills** are prerequisites to understand this concept?
3. Am I breaking down this concept into **appropriately-sized chunks** that students will be able to understand?
4. How will I elicit and connect with students’ **prior knowledge** and address any **misconceptions**?
5. What will my **step-by-step demonstration** look like? What **examples** and **non-examples** will I be using?
6. What **clear** and **concise mathematical language** will I use?

**PRACTICE**

1. How will I scaffold the **guided practice** to gradually increase the difficulty of the task while decreasing the amount of teacher guidance?
2. How will I know students are ready to move to **independent practice**?

**SUPPORTING PRACTICES**

1. What **low-level** and **high-level** **questions** will I ask throughout the lesson?
2. Is the lesson **well sequenced, focused,** and has a **brisk pace**?
3. How will I structure my lesson to include **frequent responses**,opportunities for me to **monitor** my students’ understanding, and provide **meaningful feedback**?

**Project STAIR: Explicit Instruction Essential Components EXAMPLE**

#### Mathematical concept: Solve real-life and mathematical problems using numerical and algebraic expressions and equations.

(7th grade standard and TEKS)

**MODELING**

1. What are my **goals** for this lesson?
* Review attack strategies to work through word problems.
* Solve word problems that include positive and negative integers.
1. What **vocabulary** and **skills** are prerequisites to understand this concept?
* Students will need to be familiar with word-problem attack strategies.
* Students will need to be familiar with additive and multiplicative schemas to be able to identify the problem type.
* Students will have been introduced to positive and negative integers.
* Vocabulary to review: integers, expressions, equations.
1. Am I breaking down this concept into **appropriately-sized chunks** that students will be able to understand?
* Yes.
* Students have used attack strategies in the past.
* Students are able to identify word problem types based on schemas.
* Students have been introduced to positive and negative integers.
* Students are now practicing integrating all of these components into solving word problems with positive and negative integers.
1. How will I elicit and connect with students’ **prior knowledge** and address any **misconceptions**?
* Students may confuse expressions and equations; in modeling, I will need to be clear how I determine if I am setting up an expression or equation.
* To tap prior knowledge, I will ensure that the original word problems are structured similarly to previous word problems. As students master the concept, I will add in extraneous information and change the format.
* As a warm up, I will ask students to complete word problems with positive integers only.
1. What will my **step-by-step demonstration** look like? What **examples** and **non-examples** will I be using?
* I will write my attack strategy on the board and model solving a word problem using UPSCheck, being mindful to pause and explain:
	+ How I determine if I need to set up an equation or an expression.
	+ How I determine if the numbers I use are positive or negative integers.
	+ How I solve the word problem and check my work.
* Example: Jake went swimming and dove 8 feet below the surface of the water. His friend, Ben, was swimming 5 feet above Jake. What is Ben’s position compared to the surface of the water?
	+ -8 + 5 = -3
	+ Ben is 3 feet below the surface of the water
* Jake wants to mow lawns this summer. He bought a lawn mower for $100. For every lawn he mows, he makes $20. Write an expression or equation showing how much money Jake will have depending on the number of lawns he mows this summer.
	+ -100 + 20*x* OR
	+ 20*x* – 100
1. What **clear** and **concise mathematical language** will I use?
* An integer is a whole number that can be positive, negative, or zero.
* An expression is a math sentence with a minimum or two numbers and at least one operation. It does not include an equal sign.
* An equation is a math statement in which the two mathematical expressions are equal. Equations have an equal sign.

**PRACTICE**

1. How will I scaffold the **guided practice** to gradually increase the difficulty of the task while decreasing the amount of teacher guidance?
* I will ensure that my problems include both positive and negative integers.
* I will ask for choral responses as I solve the problems using UPSCheck (students will know the steps).
* I will have students raise their hands and explain how they know a problem is asking them to set up an equation or an expression.
* I will also have students explain their reasoning regarding how they know how to set up the expression or equation using positive and negative numbers.
1. How will I know students are ready to move to **independent practice**?
* Students will be able to fluently identify the steps of UPSCheck.
* Students will be able to easily set up word problems into equations or expressions without confusing the two.
* Students will not be asking clarifying questions regarding how problems were set up.
* If needed, students still struggling with the concepts can be pulled for small group instruction.

**SUPPORTING PRACTICES**

1. What **low-level** and **high-level** **questions** will I ask throughout the lesson?
* I will ask low-level questions:
	+ What is the next step?
	+ Arithmetic questions such as negative eight plus positive five equals what?
* I will ask high-level questions:
	+ Why did you do that/choose that number?
	+ Can I use a different number or restructure this equation/expression?
	+ How do you know that is right?
1. Is the lesson **well sequenced, focused,** and has a **brisk pace**?
* This lesson builds on students’ prior knowledge of many of these skills and will flow well because they have mastered many of the concepts in isolation.
* The problems will move from easier (positive integers in equations in the warm up) to more difficult problems that require students to integrate more of their previous understandings.
* The task of solving the problem will gradually move from teacher-led examples to student-led independent practice.
* If many students are expressing confusion, I will conduct another teacher-led example.
* If only a few students are expressing confusion, I will ask students to explain to a neighbor or work together on a problem. In addition, some students may benefit from small group instruction on this topic.
1. How will I structure my lesson to include **frequent responses**,opportunities for me to **monitor** my students’ understanding, and provide **meaningful feedback**?
* Students will provide group choral responses to procedural questions.
* Students will be expected to solve problems alongside the teacher, either on a notes page or a whiteboard/desk.
* When students respond incorrectly, if the misunderstanding is at a conceptual level, I will ask the student to show me how they got an answer and address the concept they did not understand, either through questioning, asking them to look at the model problem, or working with a peer.

**Project STAIR: Multiple Representations Essential Components**

Mathematical concept:

1. Is the **purpose** of using a representation to teach this mathematical concept clear?
2. Have I chosen a representation that **accurately represents** the mathematical concept (see above)?
3. What **knowledge** and **skills** will students need *before* using this representation?
4. What are some **potential misunderstandings** students might have when using this representation?
5. What are some **logistical considerations** I should make before the lesson?

**Project STAIR: Multiple Representations Essential Components EXAMPLE**

Mathematical concept: multiplying quadratic expressions

1. Is the **purpose** of using a representation to teach this mathematical concept clear?
* Yes.
* I want students to visualize the distributive property and “see” what happens when two expressions are multiplied.
* I want students to think about what it means when two variables are multiplied.
1. Have I chosen a representation that **accurately represents** the mathematical concept (see above)?
* I have chosen to work with Algebra Blocks, either concrete or virtual sets.
* Because Algebra Blocks were specifically designed to visually represent algebraic relations, I am confident these tools are accurate representations of the concepts I want to emphasize.
1. What **knowledge** and **skills** will students need *before* using this representation?
* Students will need to know what blocks are in each set—variable bar, integer constant, *x*2, corner piece.
* Students will need to know how to set up an expression.
* Students will need to know how to record/report their thinking in multiple ways—taking a picture of their Algebra Blocks and uploading them to Schoology, taking a screenshot of their virtual Algebra Blocks and uploading that to Schoology, re-creating a drawing of their Algebra Blocks, transferring their concrete or pictorial representation into abstract notation.
* Students will need to understand principles of multiplication.
* Students will need to know the classroom expectations for using concrete and/or virtual manipulatives.
1. What are some **potential misunderstandings** students might have when using this representation?
* Students might think *x* times *x* equals 2*x.*
* Students might think three integer constants are the same value as one *x* bar (because their lengths are almost equivalent), instead of treating the *x* bar as a variable.
* Students might have difficulty translating the product inside the corner piece into abstract notation; students might struggle to “see” the multiplication.
1. What are some **logistical considerations** I should make before the lesson?
* Sets of iPads and Algebra Blocks should be easily packaged (e.g., containers of blocks) and accessible to students.
* Consider asking students using concrete manipulatives to work on trays/tables to keep blocks in sets.
* Students should have access to Schoology to upload final assignments.
* Scratch paper, pencils, erasers should be accessible.
* Consider rearranging desks/tables for students working with concrete manipulatives and students working with virtual manipulatives.



