Module Home

• Module Description: This Module describes the components of high-quality mathematics instruction: a standards-based curriculum and evidence-based strategies. It also highlights several evidence-based practices teachers can use to teach mathematics (est. completion time: 1 hour).

• STAR Legacy Cycle
• Related to This Module
  ◦ Link: Module Outline
  ◦ Video: Navigating an IRIS STAR Legacy Module
  ◦ Link: IRIS and Adult Learning Theory
  ◦ Wrap-Around Concept Map

Challenge

• Video: Over the last five years, the principals and teachers in the Lincoln School district focused their attention and resources on improving reading instruction. The result of those efforts was an increase in student reading scores. Given this success, the administrative personnel at the district level now wish to do the same for their students’ mathematics performance.

Initial Thoughts

• What is high-quality mathematics instruction and why is it important?
• What evidence-based mathematics instructional practices can teachers employ?

Perspectives & Resources

❖ Module Objectives

• After completing the entire Perspectives & Resources section and reviewing the accompanying activities, the learner will:
  ◦ Understand the importance of providing high-quality mathematics instruction
  ◦ Identify the components of high-quality mathematics instruction
  ◦ Recognize the need for implementing a standards-based mathematics curriculum
  ◦ Be familiar with evidence-based practices for teaching mathematics
  ◦ Recognize effective classroom practices that promote and support the implementation of high-quality mathematics instruction

• This IRIS Module aligns with the following licensure and program standards and topic areas...
Page 1: The Importance of High-Quality Mathematics Instruction

- Why effective mathematics instruction is so crucial
- Research Shows
- What Do the Data Indicate?
  - Consider This
- Why Do Some Students Struggle More with Math?
  - Students with Learning Disabilities
    - Link: mathematics learning disability (MLD) [definition]
    - Typical characteristics associated with MLDs [bullet points]
    - Audio: Diane Bryant describes why students with mathematics learning disabilities and those who struggle with mathematics are often grouped together in research in this area
  - English Language Learners
    - Link: academic language [definition]
- What Can Teachers Do?
  - Definition of “standards-based curriculum”
  - Definition of “evidence-based practices”
  - Research Shows
- Activity: Among the factors that influence effective high-quality mathematics instruction are teacher and student perceptions about mathematics itself
  - Link: Discover your attitudes and beliefs about mathematics and reflect on how they might influence your instruction

Page 2: A Standards-Based Mathematics Curriculum

- Among experts, the debate over the most effective method of teaching mathematics is hardly new
- Common criticisms of traditional curricula
- Purpose of the Common Core State Standards for Mathematics (CCSSM) [bullet points]
  - For Your Information
    - Audio: Diane Pedrotty Bryant discusses the purposes of the CCSSM
  - CCSSM: Standards for Mathematical Practice/Standards for Mathematical Content [graphic]
- Standards for Mathematical Practice
  - Link: National Council of Teachers of Mathematics (NCTM) [definition]
  - Link: National Research Council [definition]
  - CCSSM Standards for Mathematical Practice
- Standards for Mathematical Content
  - Kindergarten – 8th Grade
    - Eleven domains and the grade level(s) in which each is addressed [table]
High-Quality Mathematics Instruction: What Teachers Should Know

Outline

High School
- Definition of “generalization”
- Conceptual categories of high school standards [bullet points]

For Your Information
- Link: The CCSSM Website
- Link: Standards for Mathematical Practice
- Link: Standards for Mathematical Content
- Link: Standards in Your State

Curricular Materials
- Definition of “curricular materials”
  - Instructional features that teachers can look for when assessing curricular materials [drop-down table]
- Did You Know?
  - Link: U.S. Department of Education exemplary standards-based mathematics programs
  - Link: Guidelines for Design of Mathematics Instruction and Materials for ELLs [PDF]
  - An important factor to keep in mind regarding textbook developers
  - Audio: Kim Paulsen provides more information about supplementing the curriculum
  - For Your Information

Page 3: Evidence-Based Mathematics Practices

Definition of “evidence-based practices (EBPs)”
- For Your Information
  - Definition of “evidence-based practice”
  - Definition of “evidence-based program”

Why Should Teachers Use EBPs?
- Rationale for the use of EBPs
- Link: Every Student Succeeds Act (ESSA) [definition]
- Link: Individuals with Disabilities Education Act (IDEA ’04) [definition]
- Link: scientifically based research [definition]
- Some of the benefits of using EBPs [bullet points]

Identifying and Selecting EBPs
- The importance of paying attention to the information provided about EBPs
- Link: Web-based resources for determining whether a practice or program is evidence-based

Implementing EBPs with Fidelity
- Selecting an EBP is just the first step
- Definition of “fidelity of implementation”
- To implement an EBP with fidelity, a teacher should... [bullet points]
High-Quality Mathematics Instruction: What Teachers Should Know

Outline

What to do when students do not respond to EBPs
Audio: Sarah Powell discusses why educators should implement EBPs and the importance of doing so with fidelity

For Your Information
Links: related IRIS Modules

EBPs for Mathematics
Link: moderate evidence and strong evidence [definitions]
Four practices for improving student outcomes in mathematics [bullet points]
HLP and CCSSM Standards Alignment
- Link: High-Leverage Practices in Special Education
- Link: CCSSM Standards for Mathematical Practice

Page 4: Explicit, Systematic Instruction
Definition of “explicit, systematic instruction”
Explicit Components
- Link: scaffolded instruction [definition]
- Link: maintenance [definition]
Systematic Components
- Link: sample task analysis
Research Shows
How does this practice align?
Steps in an Explicit, Systematic Instruction Lesson [drop-down box]
- Link: corrective feedback [definition]
- Video: Explicit, Systematic Instruction: Elementary
- Video: Explicit, Systematic Instruction: High School
For Your Information

Page 5: Visual Representations
Definition of “visual representations”
Research Shows
A few of the visual representations most commonly used by teachers and students [drop-down menus]
How does this practice align?
Students often create visual representations that contain incorrect information
- Elementary Example
- High School Example
Manipulatives
- Definition of “manipulatives”
- The goal of using manipulatives in mathematics instruction
High-Quality Mathematics Instruction: What Teachers Should Know

Outline

Concrete-Representational-Abstract framework [drop-down box]
— Definition of “concrete”
— Definition of “representational”
— Definition of “abstract”
— For Your Information
  ◦ Audio: Kim Paulsen discusses the benefits of manipulatives and a number of things to keep in mind when using them

Page 6: Schema Instruction

• Definition of “schema”
• How does this practice align?
• Difficulty with Word Problems
  ◦ Word problems require students to...
• Research Shows
• Word Problem Structures
  ◦ Additive Schemas
    ▪ Definition of “additive schemas”
    ▪ Examples of additive schemas [drop-down menus]
    ▪ For Your Information
  ◦ Multiplicative Schemas
    ▪ Definition of “multiplicative schemas”
    ▪ Examples of multiplicative schemas [drop-down menus]
  ◦ Combined Schemas
    ▪ Definition of “combined schemas”
    ▪ Examples of combined schemas
• Audio: Sarah Powell, who has conducted extensive research on schema instruction, discusses the underlying focus of this strategy
• Teaching Word Problem Structures
  ◦ Steps for teaching combined schemas [table]

Page 7: Metacognitive Strategies

• Definition of “cognitive strategies”
• Definition of “metacognitive strategies”
• Metacognitive strategies help students learn to...
• How does this practice align?
• Research Shows
• Types of Metacognitive Strategies
  ◦ Strategy/Definition/Examples [table]
• Teaching Metacognitive Strategies

http://iris.peabody.vanderbilt.edu
High-Quality Mathematics Instruction: What Teachers Should Know

Outline

Tips for providing explicit instruction [bullet points]
- Video: Metacognitive Strategies: Elementary
- Video: Metacognitive Strategies: High School

Audio: Diane Bryant discusses the importance of teaching students cognitive and metacognitive strategies and how they benefit students

For Your Information

Page 8: Effective Classroom Practices

- Some common effective classroom practices [bullet points]
- Research Shows
- For Your Information

Encouraging Student Discussion
- Definition of “student discussion or discourse”
- To implement this practice, teachers should... [bullet points]
- How does this practice align?
- Video: A teacher encourages his students to discuss their thoughts about a series of problems

Presenting and Comparing Multiple Solution Strategies
- Benefits of the strategies
- To teach the strategies, teachers should... [bullet points]
- How does this practice align?
- Video: Presenting and Comparing Multiple-Solution Strategies

Assessing Student Understanding
- How does this practice align?
- Formative Assessment
  - Link: exit tickets [definition]
  - Link: progress monitoring [definition]
  - Link: related IRIS Module
- Error Analysis
  - Definition of “error patterns”
  - Example: Error Analysis
- Audio: Diane Bryant discusses the instructional implications for using formative feedback and error analysis
  - Link: related IRIS Case Study Unit

Page 9: References & Additional Resources

- Suggested Module citation
- References
- Additional Resources
Page 10: Credits

• Suggested Module citation
• Content Expert
• Module Developers
• Module Production Team
• Media
• Expert Interviews

Wrap Up

• Summary of the Module’s main points
• Audio: Lois Coles discusses the positive effects of using a standards-based curriculum and effective practices
• Revisiting Initial Thoughts

Assessment

• Complete the numbered questions

You Have Completed This Module

• Give Us Your Feedback
  ◦ Link: Module feedback survey form
• Professional Development Hours
  ◦ Link: IRIS PD Hours Shop
• Related Resources [links]