MATRIX OF RESEARCHED INSTRUCTIONAL PRACTICES FOR MATHEMATICS

Sources:

Institute of Education Sciences (IES) Practice Guide: *Assisting Students Struggling with Mathematics: Response to Intervention (RtI) for Elementary and Middle Schools* http://ies.ed.gov/ncee/wwc/publications/practiceguides/

National Mathematics Advisory Panel, *Foundations for Success: The final report of the National Mathematics Advisory Panel* http://www.ed.gov/about/bdscomm/list/mathpanel/index.html

Types of Instruction Reviewed:

Collaborative Learning Strategies
A specific cooperative learning set-up involving four-to-five member homogeneous teams studying together after teacher presentation. Individual quizzes are taken and rewards are at the team level.

Common Underlying Structures
Instruction in word problem solving in which students are taught to identify the structure of problems and to discriminate substantive from superficial information to identify solution methods.

Computer-Assisted Instruction
Computer-based drill and practice programs, tutorials, or their combination. Programs may also include sequenced instruction across several grade levels, tracking student progress, and maintaining records of student work.

Explicit System Instruction
Typically entails teachers explaining and demonstrating specific strategies, and allowing students many opportunities to ask and answer questions and to think aloud about the decisions they make while solving problems. It also entails careful sequencing of problems by the teacher or through instructional materials to highlight critical features.

Fluent Retrieval
Proficiency in quick retrieval of basic arithmetic facts.

Formative Assessment
The ongoing monitoring of student learning to inform instruction

Motivational Strategies
Including lesson elements that promote student effort, persistence, and achievement.

Real-World Problem Approaches
Application of mathematics concepts and problems to situations that might occur in students' lives or in future jobs.

Teacher-Directed vs. Student-Centered Instruction

Teacher-Directed: Instruction in which primarily the teacher is communicating mathematics to the students directly and in which the majority of interactions about the mathematics are between the teacher and the student.

Student-Directed: Instruction in which primarily students are doing the teaching of mathematics and the majority of the interactions about mathematics occurs between and among students.

Use of Calculators
Using calculators, including graphing calculators, for a range of purposes, from facilitating problem-solving by allowing students to perform complex arithmetic operations to serving as fact checkers.

Visual Representations
Representation of mathematical concepts with visual aids such as number lines, graphs, simple drawings of concrete objects (e.g., blocks or cups), or simplified drawings (e.g., ovals to represent birds).

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Research Finding		National Math Advisory Panel (PK-8)	Institute of Education Sciences (K-8)
STRONG EVIDENCE OF EFFECTIVENESS Or SIGNIFICANT POSITIVE EFFECTS Or CONSISTENTLY & SIGNIFICANTLY EFFECTIVE	✚	**Computer-Assisted Instruction – Drill & Practice Software** ▪ Significant positive effects for elementary students in developing automaticity (fast, accurate, and effortless performance) in computation.	**Common Underlying Structures** ▪ Significant and positive outcomes for students struggling in mathematics across grade levels **Explicit System Instruction** ▪ Improves proficiency in word problem solving and operations across grade levels and student populations
		Explicit System Instruction ▪ Consistently and significantly effective with low-achieving students in the performance of computations, solving word problems, and solving problems that require the application of mathematics to novel situations	
MODERATE EVIDENCE OF EFFECTIVENESS Or POSITIVE EFFECTS Or MARGINALLY SIGNIFICANT IN IMPROVING STUDENTS' LEARNING	+	**Collaborative Learning Strategies** in Technological Contexts ▪ Positive effects can be obtained, but they may be limited in size, especially when using simple CAI programs, and may depend on teachers' management and guidance of positive interactions and collaboration	**Formative Assessment** ▪ Moderate evidence of effectiveness for universal screening to identify students with mathematics difficulties **Fluent Retrieval** ▪ Small positive effects on fact fluency and operations in elementary grades support including fact fluency activities as stand-alone activities or components of broader instructional strategies
		Computer-Assisted Instruction ▪ Moderate effects of computer tutorials on concepts and applications for secondary grades	**Visual Representations** ▪ Statistically significant or substantively important gains in mathematics facts and operations and word problem proficiency
		Formative Assessment ▪ Marginally significant in improving students' learning; especially true if teachers have additional guidance on using the assessment to design and individualize instruction	
MIXED EFFECTIVENESS	~M	**Real-World Problem Approaches** ▪ Improves students' performance on assessments involving similar problems, but not on assessments of other aspects of mathematics learning (i.e. computation, simple word problems, and equation solving)	
LOW EVIDENCE OF EFFECTIVENESS Or MAY IMPROVE PERFORMANCE Or LIMITED EFFECTS	~L	**Collaborative Learning Strategies** ▪ May improve young children's mathematical operations	**Formative Assessment** ▪ Low evidence of effectiveness for progress monitoring of students receiving supplemental instruction
		Computer-Assisted Instruction ▪ May Improve Performance in general mathematics achievement and problem solving, depending on how it is integrated into curriculum and pedagogy	**Motivational Strategies** ▪ Motivational components are not essential but may be useful for improving math achievement
INDISCERNIBLE EFFECTS Or NO CONCLUSIVE EVIDENCE	~I	**Teacher-Directed vs. Student-Centered Instruction** ▪ No conclusive evidence to support either solely teacher-directed or solely student-centered instructional approaches ▪ Under certain conditions, teacher-directed approaches can lead to better performance in computation than student-centered approaches	
		Not Addressed Common Underlying Structures Fluent Retrieval Motivational Strategies Visual Representations	**Not Addressed** Collaborative Learning Strategies Computer Assisted Instruction Real-World Problem Approaches Teacher-Directed vs. Student-Centered Instruction Use of Calculators