

Math·U·See: A Research-based Curriculum

A look at the current recommendations on the
What Works Clearinghouse

from the
U.S. Department of Education
and the
Institute of Education Sciences



Math·U·See

<http://ies.ed.gov> · MathUSee.com/special.html

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1. Math-U-See is often asked, “Is Math-U-See research-based?”

Math-U-See has all the components that research shows are essential for students who are struggling in math: explicit instruction, systematic progress, cumulative review, hands-on manipulatives, assessment, early focus on whole numbers, strong verbalization, word problem solving, and fact fluency.

2. Which Research Recommends these Components?

The *United States Department of Education* and the *Institute of Education Sciences* teamed up to develop *Practice Guides*¹ which provide practical research-based recommendations for educators. They are developed by nationally recognized experts and are subject to rigorous external peer review.

Link to Practice Guides: <https://ies.ed.gov/pubsearch/pubsinfo.asp?pubid=WWC20094060>

One particular practice guide is *Assisting Students Struggling with Mathematics*.

Link to Specific Practice Guide:

<https://www.mathsaustralia.com.au/wp-content/uploads/IES-Practice-Guide-What-Works-Clearinghouse.pdf>

3. Report Recommendations and Math-U-See

The following is a look at the recommendations from that report and a corresponding statement of how Math-U-See meets or exceeds these recommendations.

Math-U-See is a powerful intervention tool proven to successfully reach and teach students who are at-risk or have learning disabilities. Created in 1990 as a tool to help parents teaching their children at home, Math-U-See has been utilized by thousands of students who have successfully graduated and attended major universities across the United States. Today, Math-U-See has received documentation that supports its success in the Special Education arena and recent reports. The practice guide discussed in this document supports the methodologies of the Math-U-See system that were developed over two decades ago!

We invite you to take a few moments and review this information to see for yourself how Math-U-See can make a difference in your school!

U.S. DEPARTMENT OF EDUCATION
Institute of Education Sciences

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Assisting Students Struggling with Mathematics: Response to Intervention (RtI) for Elementary and Middle Schools

Students struggling with mathematics may benefit from early interventions aimed at improving their mathematics ability and ultimately preventing subsequent failure. This guide provides eight specific recommendations intended to help teachers, principals, and school administrators use Response to Intervention (RtI) to identify students who need assistance in mathematics and to address the needs of these students through focused interventions.

Panel Recommendations

- Recommendation #1.** Screen all students to identify those at risk for potential mathematics difficulties and provide interventions to students identified as at risk.
- Recommendation #2.** Instructional materials for students receiving interventions should focus intensely on in-depth treatment of whole numbers in kindergarten through grade 5 and on rational numbers in grades 4 through 8. These materials should be selected by committee.
- Recommendation #3.** Instruction during the intervention should be explicit and systematic. This includes providing models of proficient problem solving, verbalization of thought processes, guided practice, corrective feedback, and frequent cumulative review.
- Recommendation #4.** Interventions should include instruction on solving word problems that is based on common underlying structures.
- Recommendation #5.** Intervention materials should include opportunities for students to work with visual representations of mathematical ideas and interventionists should be proficient in the use of visual representations of mathematical ideas.
- Recommendation #6.** Interventions at all grade levels should devote about 10 minutes in each session to building fluent retrieval of basic arithmetic facts.
- Recommendation #7.** Monitor the progress of students receiving supplemental instruction and other students who are at risk.

Report Recommendations

Recommendation #1. Screen all students to identify those at risk for potential mathematics difficulties and provide interventions to students identified as at risk.

How does Math·U·See meet the criteria of Recommendation #1?

Pre-screening of every student entering the Math·U·See system is a prerequisite for the use of Math·U·See. Evaluation is based on the ability of the student to demonstrate mastery of a given concept or computational process. Mastery is determined by the student using strategies and language that reflect the appropriate level of mathematics they are working on.

Example: A student who is finger-counting would be placed in our *Alpha* level materials regardless of any higher level skills being demonstrated. The *Alpha* level materials will provide successful strategies for the student to move from counting into addition and subtraction.

Recommendation #2. Instructional materials for students receiving interventions should focus intensely on in-depth treatment of whole numbers in kindergarten through grade 5 and on rational numbers in grades 4 through 8.

How does Math·U·See meet the criteria of Recommendation #2?

The basic premise of the Math·U·See System is to have students learn whole number computations first. Emphasis is placed on counting, place value, addition, subtraction, multiplication, and division of whole numbers prior to moving into fractions and decimals. The concepts taught in whole numbers are the foundation for teaching rational numbers.

Level	Main Focus
Primer	Introduction to Numbers
Alpha	Mastery of Place Value, Single-Digit Addition and Subtraction
Beta	Mastery of Multiple-Digit Addition and Subtraction
Gamma	Mastery of Multiplication
Delta	Mastery of Division
Epsilon	Mastery of Fractions
Zeta	Mastery of Decimals and Percents
Pre-Algebra	Mastery of Negative Numbers

Note: Concepts such as **Time, Money, Measurement, Inequalities, Ordinal Numbers, Graphing, Averaging, Sequencing, Estimation, Exponents, Geometry, Statistics, Solving for Unknowns**, and others are covered within these levels as they become appropriate based on skill level and understanding.

Recommendation #3. Instruction during the intervention should be explicit and systematic. This includes providing models of proficient problem solving, verbalization of thought processes, guided practice, corrective feedback, and frequent cumulative review.

How does Math-U-See meet the criteria of Recommendation #3?

The Math-U-See System provides clear models for solving all kinds of problems. The instruction for both teacher and student are explicit, structured, and cumulative. The DVD provides lesson-by-lesson instruction for the teacher is shown the model(s) being used, the language used to present the model, and the concepts being mastered. There is a definitive logical sequence to the instruction that builds cumulatively from lesson-to-lesson. There are built-in step-by-step procedures for introducing, practicing, and reviewing the concepts.

A step-by-step model has been developed and utilized within the system to ensure the teacher and the student know when they are ready to move to the next lesson.

Step 1. **Teacher Prepares for the Lesson**

- a. Watch the DVD lesson.
- b. Learn the new concept.
- c. Practice with the manipulatives to learn how to demonstrate the concept.
- d. Study the written explanations and examples.
- e. Optional: Student watches the DVD with the teacher.

Step 2. **Present the New Topic**

- a. Present the new concept to the student.
- b. **Build** the problem: Use the manipulatives to demonstrate the problems.
- c. **Write** the problem: Record the step-by-step solutions on paper as you work through the problem with the manipulatives.
- d. **Say** the problem: Explain verbally the why and what of math as you build and write.
- e. **Teach it Back:** Have the student teach the concept back to you showing that he or she fully understands it.
- f. Do as many problems as you feel are necessary until the student is comfortable with the new material. One of the joys of teaching is hearing a student say, "Now I get it!" or "Now I see it!"

Step 3. **Practice for Mastery**

- a. Use examples and lesson practice problems to develop understanding.
- b. Do enough examples together until the student can do them without assistance.
- c. Do as many problems as necessary (not all may be needed).
- d. Give special attention to word problems.
- e. Use the online drill at www.MathUSee.com to reinforce facts mastery.
- f. Use the worksheet generator if additional worksheets are needed.

Step 4. **Progression after Mastery**

- a. Once mastery is demonstrated, by the student **teaching back**, proceed to the systematic review in the student text.
- b. The goal is not to fill in worksheets, but to ensure mastery of the concept being worked upon.
- c. The systematic review worksheets (pages D, E, and F) review materials from previous lessons, as well as the new materials.
- d. Remediate missed problems as they arise to ensure continued mastery.
- e. Proceed to lesson tests.

Length of a Lesson

This will vary from student to student and from topic to topic. Daily lesson instruction time ranges from 20-45 minutes. You may spend a day on a new concept, or you may spend several days. There are so many factors that influence this process that it is impossible to predict the length of time from one lesson to another. As you regularly spend time working along with the student, you will sense when the time is right to take the lesson test and progress through the book.

By following the four steps outlined above, you will have a much greater opportunity to succeed. Math must be taught sequentially, as it builds line upon line and precept upon precept on previously learned material. By using this methodology and moving at the student's pace, you will be helping to create a confident problem solver who enjoys the study of math.

Recommendation #4. Interventions should include instruction on solving word problems that is based on common underlying structures.

How does Math·U·See meet the criteria of Recommendation #4?

Word problems require both reading and math comprehension. It is essential that students who are required to complete word problems have a thorough understanding of the reading and math concepts involved. Students who are at-risk or have disabilities can have difficulties in comprehension in one area, but not the other. To that end Math·U·See provides strategies for the teacher to work with the student to understand the context of the word problem. These strategies may include breaking the story down into smaller parts, relating the story to real life, building, drawing, acting out the story, and looking for the key words. The concrete instruction of concepts in the Math·U·See system brings understanding that is otherwise lost in traditional abstract approaches.

Recommendation #5. Intervention materials should include opportunities for students to work with visual representations of mathematical ideas and interventionists should be proficient in the use of visual representations of mathematical ideas.

How does Math·U·See meet the criteria of Recommendation #5?

The hands-on aspect of Math·U·See is the foundational component of the system. The program is built upon the use of manipulatives, rather than the manipulatives being added to support the program. The hands-on representations of the math concepts build a strong foundation that enables students to see the repetitive and cumulative nature of mathematics.

The same manipulatives are used from the beginning number recognition levels through *Algebra 1*. Concepts like subtraction and negative numbers are easily, clearly, and effectively demonstrated to the students with the same blocks. The fraction overlays present clear illustrations of all concepts related to fractions, including changing fractions to decimals and percentages.

The color coding of the Math·U·See manipulatives supports students from whole numbers through algebra. The models used continuously demonstrate that the beginning concepts of mathematics are used again with fractions, decimals, and algebra problems. This builds a sense of confidence within students, who may be confused by the different terms used in mathematics.

Recommendation #6. Interventions at all grade levels should devote about 10 minutes in each session to building fluent retrieval of basic arithmetic facts.

How does Math·U·See meet the criteria of Recommendation #6?

Too often students struggle in mathematics because they are taught counting strategies and are not successfully taught addition and subtraction strategies. The Math·U·See system focuses from the very beginning on making sure students are not only taught, but master, the basic facts needed to do mathematics efficiently. Mastery of a concept is not based solely on getting the right answer, but on getting it quickly and efficiently. Counting strategies are very limited as Math·U·See effectively moves students beyond counting.

Math·U·See provides free online drill for addition, subtraction, multiplication, and division facts through our website. The teacher can choose the problem sets the student needs to work on, and then the student is given up to 20 problems. At the end of the session the student is shown how many were right, how many were wrong, and the amount of time it took to complete the session. Math·U·See encourages students to keep track of their times each day and after a week look to see how they have improved. Ideally, we expect that a student will do 20 problems in under 60 seconds and have all the answers correct in order to demonstrate mastery.

Recommendation #7. Monitor the progress of students receiving supplemental instruction and other students who are at risk.

How does Math-U-See meet the criteria of Recommendation #7?

As a tier 3 intervention, there are several components of Math-U-See that call for regular assessment and measurement. The goal is to develop students who are confident problem-solvers. In order to accomplish the goal, continued monitoring of instruction is needed to determine the mastery level of the student.

A list of **WHAT WORKS²** in a tier 3 intervention has been developed by Pat Carpenter from past experience in the Albuquerque Publics School System.

1. **Teacher Training**

- a. Teacher attends training provided by a certified trainer.
- b. Teacher uses the components of the program as described in training.
- c. Teacher attends follow-up/study group session provide by the district.
- d. Technical classroom support is provided by the district.

2. **Target the Students**

- a. Small group instruction – preferably one-on-one, but no more than five.
- b. No more than two pre-tested levels of instruction being taught per class period.

3. **Fidelity**

- a. Teacher uses all of the Math-U-See program components.
- b. Teacher prepares for lesson by viewing the DVD and reading the manual.
- c. Explicit lesson instruction: Build, Write, Say, Teach Back.
- d. Students demonstrate mastery.
- e. Daily ongoing assessment which drives the instruction.
- f. Teachers follow lesson plan and flow chart.
- g. Monitoring of fidelity is recommended by the district.

4. **Scheduling**

- a. Students placed according to Math-U-See competency test.
- b. Have a least two SPED math teachers teaching math at the same time which allows for flexible placement of students in paced classes.

5. **Lessons**

- a. Math-U-See taught 4–5 days per week, as a **core replacement program**.
- b. Math instruction is **at least 45 minutes** per session.

Note: Recommendation #8 is not curriculum dependent. Therefore it does not apply to this document.

You can always jump online and visit our website. We have in-depth overviews of each level, as well as extra manipulatives and multi-sensory instruction videos.

See you there!

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Reference Sources

¹Gersten, R., Beckmann, S., Clarke, B., Foegen, A., Marsh, L., Star, J. R., & Witzel, B. (2009). Assisting students struggling with mathematics: Response to Intervention (RtI) for elementary and middle schools (NCEE 2009-4060). Washington, DC: National Center for Education Evaluation and Regional Assistance, Institute of Education Sciences, U.S. Department of Education. Retrieved from <http://ies.ed.gov/ncee/wwc/publications/practiceguides/>.

The original report is available on the IES website at <http://ies.ed.gov/ncee> and <http://ies.ed.gov/ncee/wwc/publications/practiceguides/>.

²Carpenter, Pat., Math Liaison, Albuquerque Public School District, Special Education Math Unit, July 2009, Math-U-See Tier 3 Special Education Intervention, "What works: Teacher Training Component"