

A Guide to Selecting and Applying Evidence-Based Practices to Mathematics

USDE guidance defines four levels of evidence for evaluating the strength of evidence indicating the effectiveness of a given program or intervention. These range from “Strong Evidence” to “Demonstrates a Rationale.” Throughout this guide, these levels of evidence will be referred to as “Tier 1,” “Tier 2,” etc. as shown in the table below.

Tier	Level of Evidence	Description
1	Strong Evidence	Supported by one or more well-designed and well-implemented randomized control experimental studies .
2	Moderate Evidence	Supported by one or more well-designed and well-implemented quasi-experimental studies .
3	Promising Evidence	Supported by one or more well-designed and well-implemented correlational studies .
4	Demonstrates a Rationale	Practices that have a well-defined logic model or theory of action , are supported by research, and have some effort underway to determine their effectiveness.

The Tables below are organized into four areas of activity:

1. Program Planning
2. Classroom Strategies
3. Professional Development
4. Extended Learning Settings

Evidence-Based Practice and Rationale	Grade Band	Level of Evidence and Source
<p>Dedicate time each day to teaching math, and integrate math instruction throughout the school day.</p> <p><i>Current math objectives should be coordinated with activities in the classroom and lessons in other subject areas so children can master skills and extend concepts.</i></p>	<p>PreK-3</p>	<p>Tier 1, Strong</p> <p>Source: Frye, D., Baroody, A. J., Burchinal, M., Carver, S. M., Jordan, N. C., & McDowell, J. (2013). <i>Teaching math to young children: A practice guide</i> (NCEE 2014-4005), Washington, DC.</p> <p>https://ies.ed.gov/ncee/wwc/Docs/PracticeGuide/early_math_pg_111313.pdf</p>
<p>Provide explicit and systematic intervention instruction.</p> <p><i>Struggling students should receive explicit instruction to ensure that they have the foundational skills and conceptual knowledge necessary for understanding grade-level content.</i></p>	<p>PreK-3 4-5 6-8</p>	<p>Tier 1, Strong</p> <p>Source: Gersten, R., Beckmann, S., Clarke, B., Foegen, A., Marsh, L., Star, J. R., & Witzel, B. (2009). <i>Assisting students struggling with mathematics: Response to Intervention (RtI) for elementary and middle schools</i> (NCEE 2009-4060). Washington, DC.</p> <p>https://ies.ed.gov/ncee/wwc/Docs/PracticeGuide/rti_math_pg_042109.pdf</p>

Evidence-Based Practice and Rationale	Grade Band	Level of Evidence and Source
<p>Demonstrate multiple problem-solving strategies.</p> <p><i>Exposing students to problems that are solved using multiple strategies enables students to become more efficient in selecting appropriate ways to solve math problems with greater ease and flexibility.</i></p>	<p>4-5 6-8</p>	<p>Tier 2, Moderate</p> <p>Source: Woodward, J., Beckmann, S., Driscoll, M., Franke, M., Herzig, P., Jitendra, A., Koedinger, K. R., & Ogbuehi, P. (2012). <i>Improving mathematical problem solving in grades 4 through 8: A practice guide</i> (NCEE 2012-4055). Washington, DC.</p> <p>https://ies.ed.gov/ncee/wwc/Docs/PracticeGuide/mps_pg_052212.pdf</p>
<p>Recognize and articulate mathematical concepts and notation.</p> <p><i>Explaining relevant concepts and notation in the context of a problem-solving activity, prompting students to describe how worked examples are solved using mathematically valid explanations, and introducing algebraic notation systematically helps students develop new ways of reasoning, which will help them solve mathematical problems.</i></p>	<p>4-5 6-8</p>	<p>Tier 2, Moderate</p> <p>Source: Woodward, J., Beckmann, S., Driscoll, M., Franke, M., Herzig, P., Jitendra, A., Koedinger, K. R., & Ogbuehi, P. (2012). <i>Improving mathematical problem solving in grades 4 through 8: A practice guide</i> (NCEE 2012-4055). Washington, DC.</p> <p>https://ies.ed.gov/ncee/wwc/Docs/PracticeGuide/mps_pg_052212.pdf</p>
<p>Utilize the structure of algebraic representations.</p> <p><i>Understanding structure helps students make connections among problems presented in different forms.</i></p>	<p>6-8 9-12</p>	<p>Tier 1, Strong</p> <p>Source: Star, J. R., Caronongan, P., Foegen, A., Furgeson, J., Keating, B., Larson, M. R., Lyskawa, J., McCallum, W. G., Porath, J., & Zbiek, R. M. (2015). <i>Teaching strategies for improving algebra knowledge in middle and high school students</i> (NCEE 2014-4333). Washington, DC.</p> <p>https://ies.ed.gov/ncee/wwc/Docs/PracticeGuide/wwc_algebra_040715.pdf</p>
<p>Solve problems by intentionally choosing alternative algebraic strategies.</p> <p><i>Learning and accessing multiple algebraic strategies enables students to approach algebra problems with flexibility. Comparing solution strategies can help deepen students' conceptual understanding allowing them to extend knowledge and think abstractly.</i></p>	<p>6-8 9-12</p>	<p>Tier 1, Strong</p> <p>Source: Star, J. R., Caronongan, P., Foegen, A., Furgeson, J., Keating, B., Larson, M. R., Lyskawa, J., McCallum, W. G., Porath, J., & Zbiek, R. M. (2015). <i>Teaching strategies for improving algebra knowledge in middle and high school students</i> (NCEE 2014-4333). Washington, DC.</p> <p>https://ies.ed.gov/ncee/wwc/Docs/PracticeGuide/wwc_algebra_040715.pdf</p>

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<p>Implement curriculum that is focused and coherent and based on the learning progressions that are foundational to algebra.</p> <p><i>Requisite skills and understandings are necessary for students to be prepared for success in Algebra I.</i></p>	<p>6-8</p>	<p>Tier 3, Promising</p> <p>Source: Smith, Toni M. (2014). <i>Curricular Alignment to Support Student Success in Algebra I: Research Brief</i> (American Institutes for Research 2014) Washington, DC.</p> <p>https://www2.ed.gov/programs/dropout/curricularalignment092414.pdf</p>

3. Professional Development

Evidence-Based Practice and Rationale	Grade Band	Level of Evidence and Source
<p>Provide professional learning that is intensive, ongoing and connected to practice.</p> <p><i>Intensive professional learning that includes applications of knowledge to teachers' planning and instruction influences teaching practices and leads to gains in student learning.</i></p>	<p>4-5 6-8 9-12</p>	<p>Tier 1, Strong</p> <p>Source: Wei, R.C., Darling-Hammond, L., Andree, A., Richardson, N., Orphanos, S. (2009). <i>Professional Learning in the Learning Profession: A status report on teacher development in the United States and abroad</i>. Dallas, TX. National Staff Development Council (2009).</p> <p>https://learningforward.org/docs/default-source/pdf/nsdcstudytechnicalreport2009.pdf</p>
<p>Focus on student learning and the teaching of specific curriculum content.</p> <p><i>Professional learning is most valuable when it provides opportunities to do hands-on work that builds the knowledge of academic content and how to teach it to students.</i></p>	<p>PreK-3 4-5 6-8 9-12</p>	<p>Tier 1, Strong</p> <p>Source: Wei, R.C., Darling-Hammond, L., Andree, A., Richardson, N., Orphanos, S. (2009). <i>Professional Learning in the Learning Profession: A status report on teacher development in the United States and abroad</i>. Dallas, TX. National Staff Development Council (2009).</p> <p>https://learningforward.org/docs/default-source/pdf/nsdcstudytechnicalreport2009.pdf</p>
<p>Align professional learning with school priorities and goals.</p> <p><i>Professional learning that is an integral part of a larger school reform effort is more effective than isolated professional learning activities.</i></p>	<p>PreK-3 4-5 6-8 9-12</p>	<p>Tier 1, Strong</p> <p>Source: Wei, R.C., Darling-Hammond, L., Andree, A., Richardson, N., Orphanos, S. (2009). <i>Professional Learning in the Learning Profession: A status report on teacher development in the United States and abroad</i>. Dallas, TX. National Staff Development Council (2009).</p> <p>https://learningforward.org/docs/default-source/pdf/nsdcstudytechnicalreport2009.pdf</p>
<p>Build relationships among teachers.</p> <p><i>The benefits of productive relationships include better instruction and more success in solving the problems of practice.</i></p>	<p>PreK-3 4-5 6-8 9-12</p>	<p>Tier 1, Strong</p> <p>Source: Wei, R.C., Darling-Hammond, L., Andree, A., Richardson, N., Orphanos, S. (2009). <i>Professional Learning in the Learning Profession: A status report on teacher development in the United States and abroad</i>. Dallas, TX. National Staff Development Council (2009).</p> <p>https://learningforward.org/docs/default-source/pdf/nsdcstudytechnicalreport2009.pdf</p>

4. Extended Learning Settings

Evidence-Based Practice and Rationale	Grade Band	Level of Evidence and Source
<p>Adapt instruction to individual and small group needs.</p> <p><i>Supplementing learning from the school day and providing targeted assistance to students whose needs extend beyond what they can receive in the classroom instruction must be focused and targeted. Closely aligning the content and pacing of instruction with student needs will result in better student performance. Determining the right level of difficulty and pace and the most appropriate skills to teach is critical to effectively individualizing instruction.</i></p>	<p>PreK-3 4-5 6-8 9-12</p>	<p>Tier 2, Moderate</p> <p>Source: Beckett, M., Borman, G., Capizzano, J., Parsley, D., Ross, S., Schirm, A., & Taylor, J. (2009). <i>Structuring out-of-school time to improve academic achievement: A practice guide</i> (NCEE #2009-012). Washington, DC.</p> <p>https://ies.ed.gov/ncee/wwc/Docs/PracticeGuide/ost_pg_072109.pdf</p>
<p>Maximize student attendance and participation.</p> <p><i>Student participation is affected by issues of access and convenience, as well as by the adequacy and attractiveness of the services and features provided in the program. Minimize the barriers to participation, especially for the students most in need of program services and most likely to benefit from them.</i></p>	<p>PreK-3 4-5 6-8 9-12</p>	<p>Tier 4, Demonstrates a Rationale</p> <p>Source: Beckett, M., Borman, G., Capizzano, J., Parsley, D., Ross, S., Schirm, A., & Taylor, J. (2009). <i>Structuring out-of-school time to improve academic achievement: A practice guide</i> (NCEE #2009-012). Washington, DC.</p> <p>https://ies.ed.gov/ncee/wwc/Docs/PracticeGuide/ost_pg_072109.pdf</p>
<p>Use program assessment to improve quality.</p> <p><i>Both formative and summative evaluations are instrumental in any program improvement effort. Programs should have internal mechanisms to monitor staff performance, collect data related to program implementation, and conduct independent evaluations of program implementation and student impact.</i></p>	<p>PreK-3 4-5 6-8 9-12</p>	<p>Tier 4, Demonstrates a Rationale</p> <p>Source: Beckett, M., Borman, G., Capizzano, J., Parsley, D., Ross, S., Schirm, A., & Taylor, J. (2009). <i>Structuring out-of-school time to improve academic achievement: A practice guide</i> (NCEE #2009-012). Washington, DC.</p> <p>https://ies.ed.gov/ncee/wwc/Docs/PracticeGuide/ost_pg_072109.pdf</p>

Evidence-Based Practice and Rationale	Grade Band	Level of Evidence and Source
<p>Provide algebra readiness programs targeting skills to prepare for enrollment in Algebra 1.</p> <p><i>Achievement improves when there is a combination of academic and social focus. Implementation practices for success include selecting qualified staff, using curricula for focused program activities, providing individualized attention and supports to students, setting clear expectations and structures for participants, using age- and culturally appropriate materials, and monitoring program performance.</i></p>	<p>6-8 9-12</p>	<p>Tier 2, Moderate</p> <p>Source: Sorensen, Nicholas. (2014). <i>Supplementary Learning Strategies to Support Student Success in Algebra I: Research Brief</i> (American Institutes for Research 2014) Washington, DC.</p> <p>https://www2.ed.gov/programs/dropout/learningsupports092414.pdf</p>
