HANOVER RESEARCH

BEST PRACTICES

Improving Math Proficiency Among Students with Disabilities in K-12 Schools

Prepared for the School of Education at the University of Mississippi

June 2025

In the following report, Hanover Research presents the results of a best practices analysis of math proficiency in K-12 schools, with a specific focus on math proficiency levels among students with disabilities.

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EXECUTIVE SUMMARY

RECOMMENDATIONS

Based on its best practices analysis, Hanover recommends that the School of Education at the University of Mississippi (Ole Miss Education):

LEVERAGE DATA AND TECHNOLOGY TOOLS TO PROVIDE CUSTOMIZED SUPPORT TO LEARNERS WITH DISABILITIES.

Case studies on rural school districts that have made strides with math proficiency for students with disabilities make strong use of student data and technology-based tools to optimize their instructional practices. For example, the Piedmont City School District in a rural Alabama, rose from 35th to 12th in the state math rankings by using data to plan and monitor instruction for struggling students. Notably, the district held monthly "data days" during which teachers examined student performance on assessments to identify learning gaps and ultimately inform math instruction. While this practice is not specifically targeted to students with disabilities, it aligns with successful strategies for this audience, which include using continuous formative assessments, such as weekly quizzes, to proactively screen students and implement interventions. Piedmont City Schools also invested in technology prior to the COVID pandemic, which helped mitigate the impacts of required remote learning. The school district also incorporated more traditional elements like lengthening teaching periods for math and other core subjects and use of small group instruction to allow for more personalized student support.

Similarly, a study an anonymous rural school district unveiled substantial improvements in math scores for students with disabilities through Interleaved Practice Format (IPF), which relies on technologies like KUTA and ChatGPT. Through IPF and its associated technologies, students with disabilities are presented with a mix of problems that reportedly promote cognitive challenge, problem-solving flexibility, and learning retention. Notably, this strategy does not require additional funding or training and is ideal for rural or under-resourced schools.

USE TEACHING PRACTICES THAT ADDRESS THE UNIQUE NEEDS OF STUDENTS WITH DISABILITIES.

Many of the best practices suggested by experts promote instructional practices that address learning differences and challenges unique to students with disabilities. For example, these students often struggle with problem-solving and abstract concepts. Strategies like metacognitive strategy and explicit instruction use techniques like graphic organizers or checklists, "think-aloud" problem solving, and structured, systematic examples that make problem-solving steps transparent. Additionally, schema-based instruction teaches students to categorize problems by type (e.g., compare, change, combine) and apply a consistent solving schema. Finally, visual representations like manipulatives, visual aids, and drawings can help students translate abstract concepts (e.g., fractions, equations, etc.) into concrete objects or visuals, which is particularly helpful for students with learning disabilities.

EXECUTIVE SUMMARY

KEY FINDINGS

U.S. K-12 schools use standardized assessments to evaluate math proficiency, primarily through state assessments and the National Assessment of Educational Progress (NAEP).

- State assessments align with state standards, reporting the percentage of students achieving proficiency, while NAEP offers a national benchmark across states for grades 4 and 8, categorizing performance as Basic, Proficient, or Advanced.
- Most students with disabilities participate in these general assessments with necessary accommodations, though a small percentage with significant cognitive disabilities are assessed using alternative exams.
- The Every Student Succeeds Act mandates states to report math achievement for various subgroups, including students with disabilities, ensuring disaggregated data under the Individuals with Disabilities Education Act.

Recent trends in math proficiency have been noticeably impacted by the COVID-19 pandemic.

- National proficiency rates declined for the overall student population from 2019 to 2022, and students with disabilities experienced similar declines.
- Pandemic-related disruptions, such as lost instructional time and remote learning challenges, affected all student groups, but chronic absenteeism and special education teacher shortages exacerbated the impact for students with disabilities.
- Interestingly, rural districts experienced smaller setbacks in math compared to urban and suburban districts, losing roughly half a year of learning versus greater losses in other areas.
- This trend slightly narrowed math achievement gaps by urbanicity, although the reasons for rural districts' relative resilience are still being investigated.

National data reveal significant achievement gaps in math proficiency between students with versus without disabilities.

- NAEP data illustrate 30+ point differences between the percentage of students with versus without disabilities scoring at or above the NAEP Basic math proficiency level.
- For example, at the 8th grade level, 28 percent of students with disabilities scored at or above the NAEP Basic level, compared to 67 percent of students without disabilities.
- NAEP data also reveal differences in math achievement based on urbanicity, with suburban students typically outperforming urban and rural students in math proficiency exams.

Math proficiency levels vary significantly across states, and those that score well on the NAEP test for all students are not always the top performers for students with disabilities.

- These variations highlight pronounced differences in math outcomes across states for both general and special education populations in elementary and middle school.
- Notably, the District of Columbia and West Virgina score low among all students and for students with disabilities, while Massachusetts scores among the best in both categories
- States with the smallest gaps between the general population and students with disabilities include Wyoming, Mississippi, Louisiana and Florida.

NAEP Math Scores 2024	High Math Proficiency	Low Math Proficiency
General Student Population	Massachusetts, Minnesota, Wisconsin, New Jersey	West Virginia, Alabama, Mississippi, District of Columbia
Students with Disabilities	Florida, Massachusetts	Hawaii, District of Columbia, New Mexico, West Virginia

RESEARCH QUESTIONS AND METHODOLOGY

BACKGROUND

The School of Education at the University of Mississippi (Ole Miss Education) hosts the National Center for School-University Partnerships (NCSUP), which connects partner universities and public school districts to collectively address problems in K-12 school districts. Using a process of continuous improvement, collective problem solving and practice-based evidence, the NCSUP members strive to promote student success and high-quality education. Members pay an annual fee to belong to the NCSUP and commit to at least a two-year partnership.

A major initiative of the NCSUP is improving math proficiency in K-12 schools, particularly among disabled students. Students with limited math proficiency are likely at higher risk for not graduating from high school and are also less likely to enroll in higher education programs. NCSUP is committed to finding meaningful and effective solutions using its existing members to test possible solutions. As such, Ole Miss Education and NCSUP would like to develop standard documentation on the current state of math proficiency in public schools, in general, but also in comparison to students with disabilities nationally.

METHODOLOGY

Hanover reviewed recent literature on improving math proficiency to explore the metrics used to quantify the problem overall and specifically for students with disabilities. As data permits, Hanover provided comparisons among different age groups (elementary/middle vs high school) and settings (urbanicity) and data by geography to assess the geographic areas most impacted. In addition, Hanover analyzed best practices for improving math proficiency and showcased exemplary districts and evidence-backed interventions in rural school districts. This research primarily comes from academic literature, advice from education experts, and government databases.

RESEARCH QUESTIONS

Is there a common measurement of math proficiency among K-12 schools, and for the general school population versus the disabled student community?

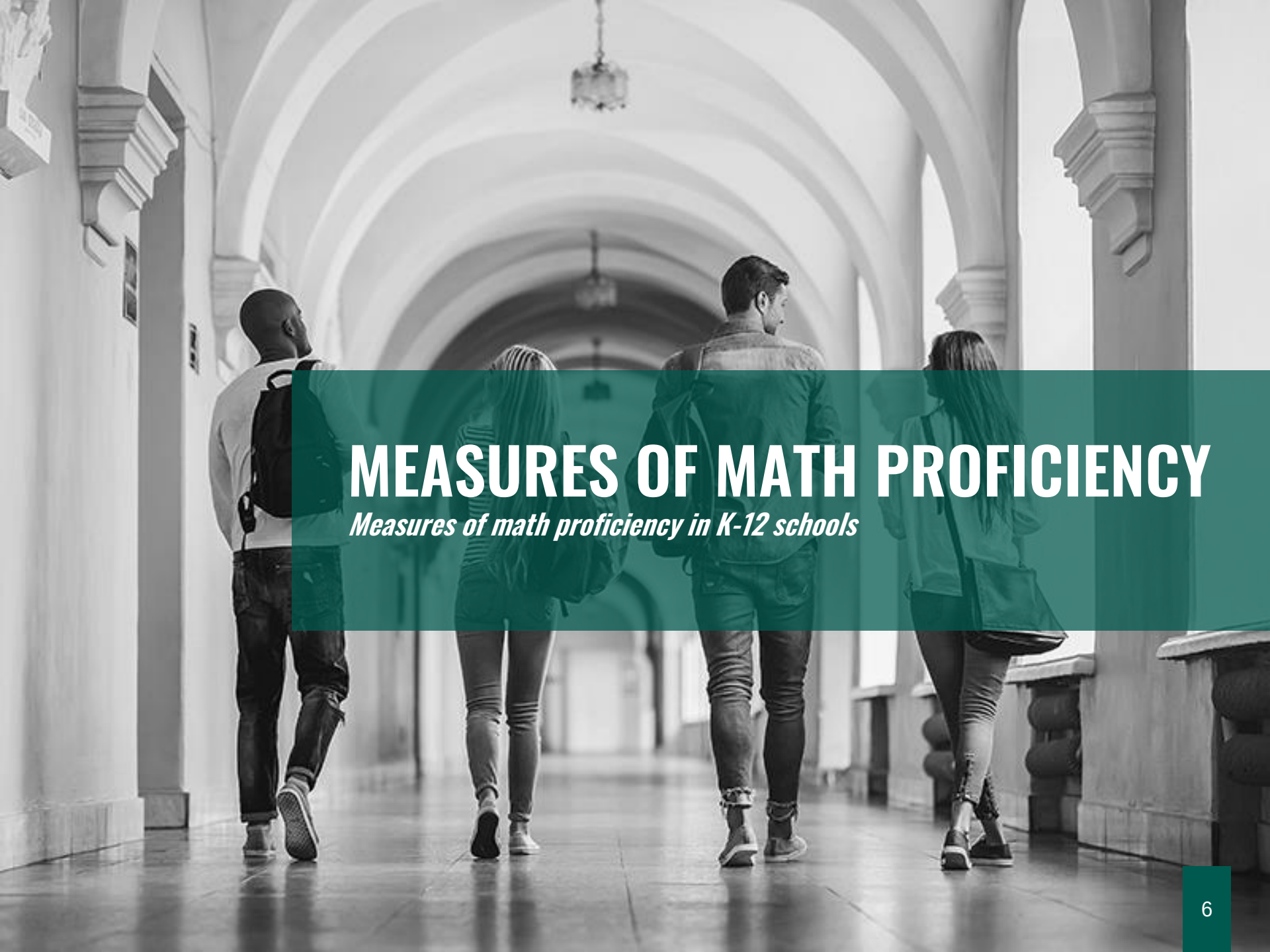
- Is there variance in these rates among states?
- What are the trends in these metrics over the last 3-5 years, as available?
- Are there variances between rural and non rural areas?

Is there ranking of states that shows which geographic areas have a greater or lesser problem with low math proficiency in a post-Covid environment?

- Where are the greatest problems?

What are the best practices for K-12 districts to consider when evaluating efforts to combat low math proficiency?

- What are methods that work or have successfully been employed to increase math proficiency, particularly among disabled children?
- Are there profiles of successful districts or schools that can be used and replicated?



MEASURES OF MATH PROFICIENCY

Measures of math proficiency in K-12 schools

OVERVIEW – MEASURES OF MATH PROFICIENCY IN K-12

ANALYSIS

U.S. K-12 schools rely on standardized assessments to gauge math proficiency. The two primary measures are **state assessments** (aligned to state standards, often reported as the percentage of students scoring "proficient" or above) and the National Assessment of Educational Progress (NAEP), known as the Nation's Report Card. NAEP provides a common benchmark across states at 4th, 8th (and sometimes 12th) grades, with performance levels defined as *Basic*, *Proficient*, or *Advanced*, defined on the right of the page. Because state-administered exams vary in rigor, proficiency rates on state tests often exceed NAEP proficiency rates, thus highlighting a standards gap in many states (Toch and DiMarco).

NAEP PROFICIENCY LEVELS

As defined by the NAEP.

BASIC ★☆☆	**NAEP Basic** denotes partial mastery of the knowledge and skills that are fundamental for proficient work at a given grade.
PROFICIENT ★★☆	**NAEP Proficient** represents solid academic performance for the given grade level and competency over challenging subject matter including subject-matter knowledge, application of such knowledge to real world situations, and analytical skills appropriate to the subject matter.
ADVANCED ★★★	**NAEP Advanced** presumes mastery of both the NAEP Basic and NAEP Proficient levels and represents superior academic performance.

Most students with disabilities take the same general assessments as students without disabilities, with accommodations as needed. A small percentage with significant cognitive disabilities (around one percent) are assessed via alternate exams, known as the alternative academic achievement standards (AA-AAAS).

Under the Every Student Succeeds Act, states must report math achievement for subgroups, including *students with disabilities*, who are typically defined as those with an Individualized Education Program (IEP). According to the Department of Education, the ESSA also requires the disaggregation of assessment results by student subgroups, including studnets with disabilities as defined under the Individuals with Disabilities Education Act (IDEA). **Thus, math proficiency for students with disabilities is measured in parallel to the general student population, enabling comparisons of performance gaps.**

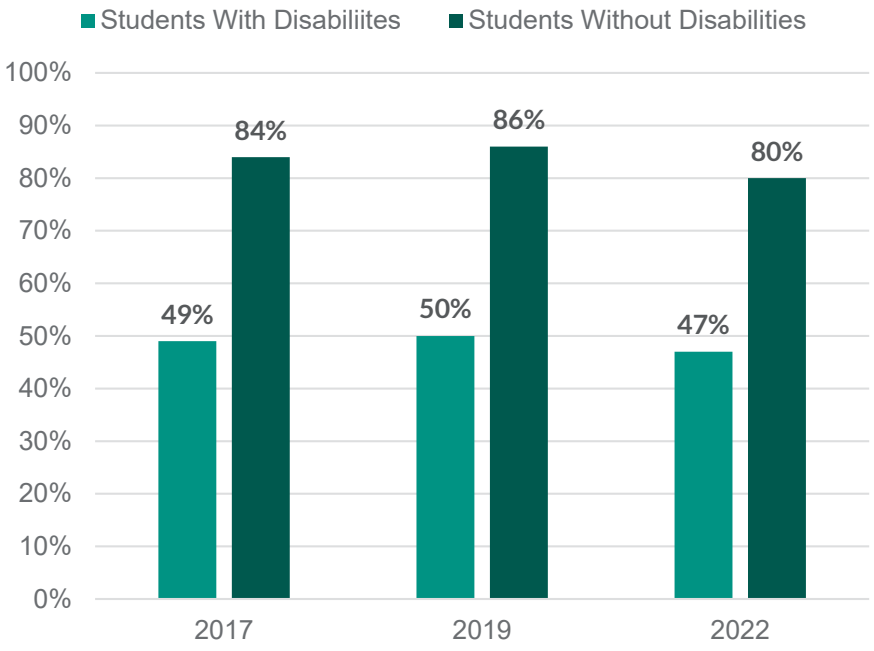
MATH PROFICIENCY RATES: STUDENTS WITH VS WITHOUT DISABILITIES

ANALYSIS

National data consistently show large achievement gaps. For example, in NAEP's 2017 8th-grade math assessment, only about nine percent of students with disabilities reached the Proficient level (and ~69 percent scored Below Basic), compared to 38 percent of students without disabilities scoring Proficient. The data below illustrate 30+ point differences between the percentage of studnets with versus without disabilities scoring at or above the NAEP Basic math proficiency level. The largest gap is shown at the 8th grade level, wherein 28 percent of students with disabilities scored at or above the NAEP Basic level, while 67 percent of students without disabilities scored at or above this level in 2022. These comparisons highlight that while overall U.S. math performance is concerning, outcomes for students with disabilities are especially low.

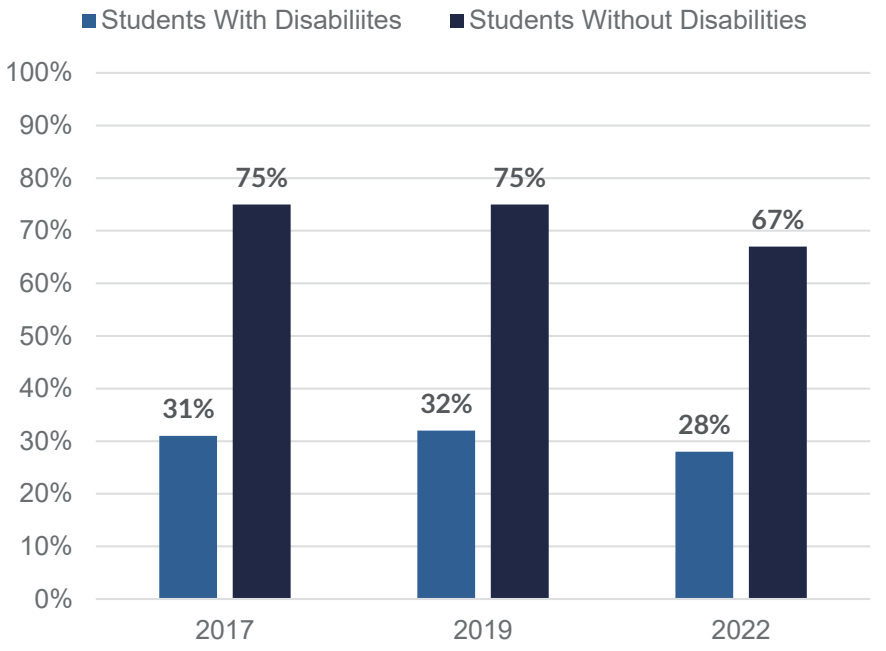
STUDENTS AT OR ABOVE NAEP BASIC, 4TH GRADE

Breakdown of 4th grade students with versus without disabilities at or above the NAEP Basic math proficiency level, 2017-2022.



STUDENTS AT OR ABOVE NAEP BASIC, 8TH GRADE

Breakdown of 8th grade students with versus without disabilities at or above the NAEP Basic math proficiency level, 2017-2022.



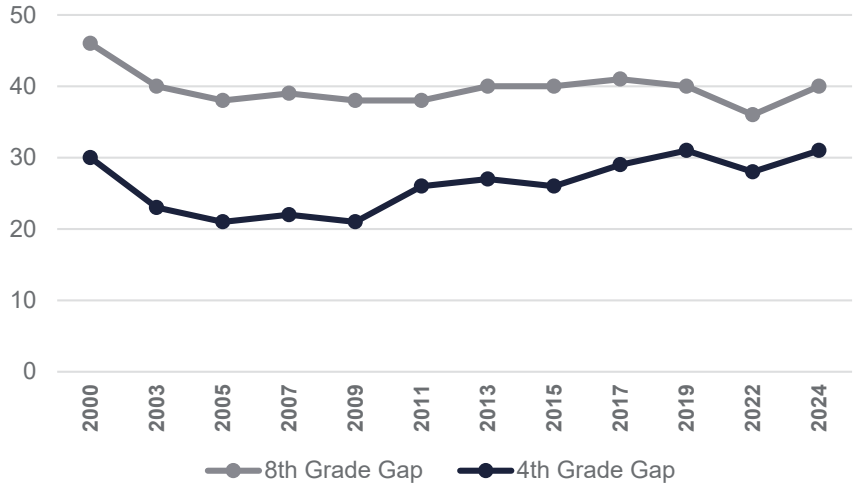
Source: NAEP Report Card: Mathematics

MATH NAEP SCORES NATIONALLY FOR STUDENTS WITH IDENTIFIED DISABILITY

ANALYSIS

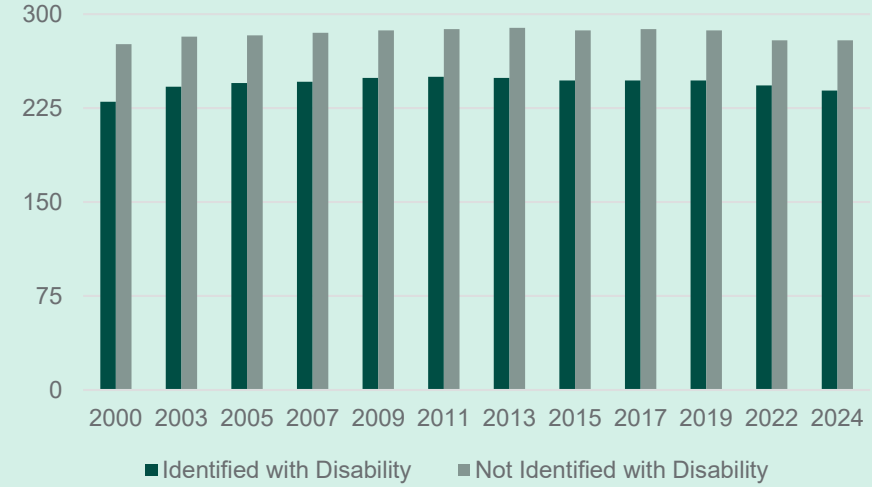
Nationally, the NAEP math test scores of students with disabilities have improved from 198 points to 211 points between 2000 and 2024 at the 4th grade level. For 8th graders, there were similar improvements from 230 to 239 at the national level. Students without identified disabilities also showed improvement over the same period, but at lower levels among 8th graders. Details are shown at the graphs at right.

Significant gaps between students identified with a disability and those without remain. A **31-point gap currently exists between students identified with and without disabilities among 4th graders. That gap increases by 8th grade, with the 2024 results showing 40 points of difference between the two student groups.** The variance among students in 8th grade has improved since 2000, but the variance between 4th graders has grown slightly from 2000 rates, despite improvements in the intervening years.



Students Identified with Disability, 4th Grade Scores

Students Identified with Disability, 8th Grade Scores



HIGHER EDUCATION

Source: NDE Core Web

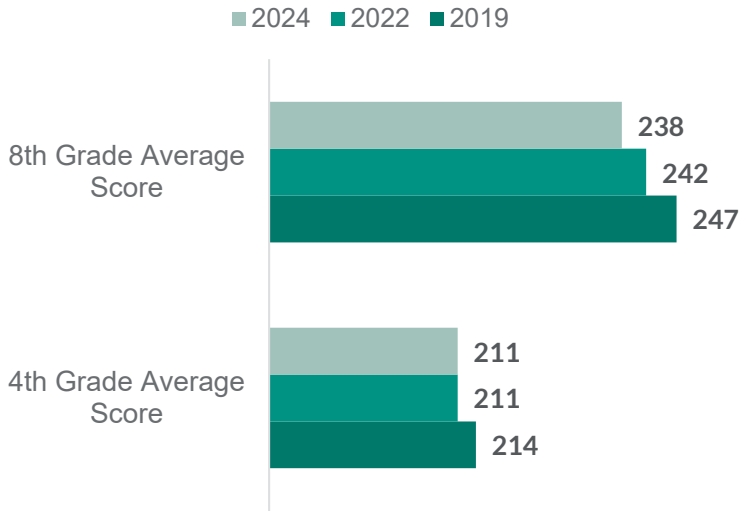
PRE- AND POST-COVID TRENDS IN MATH PROFICIENCY SCORES

ANALYSIS

Recent trends are heavily influenced by the COVID-19 pandemic's impact. From 2019 to 2022, NCES reported a decline in math proficiency rates nationwide, erasing gains made over the prior decade. Further, NAEP results reported by K-12 Dive showed significant drops: the national average math scores fell five points at 4th grade and eight points at 8th grade between 2019 (pre-pandemic) and 2022. **For students with disabilities, math performance also fell or stagnated.** Specifically, 8th grade students with disabilities NAEP scores dropped from 247 (2019) to 238 (2024) on NAEP's 500-point scale. However, these declines for special education students mirrored the overall declines; experts note that pandemic disruptions (lost instructional time, remote learning challenges) hit all student groups, and chronic absenteeism plus shortages of special education teachers likely exacerbated the impact for students with disabilities (K-12 Dive). In short, the last three to five years have seen worrisome downward trends in math proficiency across the board, with students with disabilities remaining substantially behind their peers.

AVERAGE NAEP MATH PROFICIENCY SCORES AMONG STUDENTS WITH DISABILITIES

Shows average NAEP Math Proficiency Score for 4th and 8th grade students with disabilities from 2019 to 2024.



Source: K-12 Dive

MATH PROFICIENCY VARIATIONS BY DISTRICT TYPE

There are notable differences in math achievement by urbanicity, though NAEP data shows these gaps primarily exist for rural and urban students when compared to suburban students. That is, suburban students scored higher on math proficiency exams than their urban and rural counterparts as of 2022 data. However, there are exceptions to this trend.

During the pandemic, rural districts appeared to fare better in math than many urban counterparts. An analysis of 2022 learning loss data found ***rural schools suffered the smallest COVID-related setbacks in math. These students lost roughly half a year of learning lost, compared to an equivalent of 65 percent of a year lost in urban districts and 54 percent in suburban districts.***

In other words, while all locales saw declines, rural students' math performance dropped less sharply on average, even as their reading losses were greater. The reasons are still being investigated (potentially rural schools returned to in-person learning sooner or had smaller class sizes), but this recent trend slightly narrowed math gaps by urbanicity in the short term.

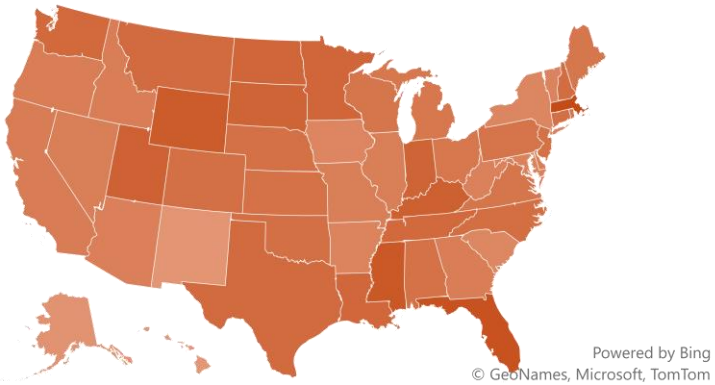
MATH NAEP SCORES BY STATE FOR STUDENTS WITH IDENTIFIED DISABILITY

ANALYSIS

In 2024, Math NAEP scores showed wide variance between states at both the 4th and 8th grade levels among students identified with a disability (inclusive of those with a 504 plan). Excluding the Department of Defense schools in Europe and Asia (DODEA), Massachusetts consistently scored well across all students and had the highest scores at the 4th and 8th grade levels for students with a disability. Puerto Rico consistently scored the lowest, but interestingly, the state ranking for the highest and lowest scores among students with disabilities changed between 4th and 8th grade.

Among 4th graders, the average score for students identified with a disability was 211. The top ranked state of Massachusetts achieved a 227 among students with a disability compared to Puerto Rico at 171. **Among 8th graders, the average score was 239.** Massachusetts students with a disability scored 251, while Puerto Rico scored 216.

Students Identified with Disability, 4th Grade Scores



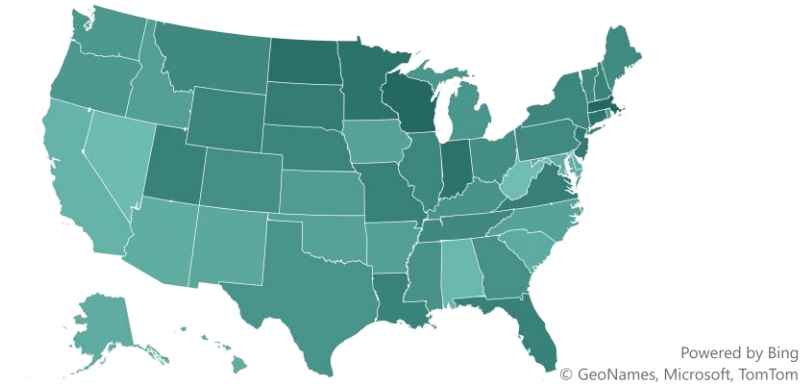
Avg Math Scores

171 234

Highest Scores
- Massachusetts
- Florida
- Mississippi
- Wyoming
- Kentucky

Lowest Scores
- Puerto Rico
- Hawaii
- New Mexico
- Alaska
- Washington DC

Students Identified with Disability, 8th Grade Scores

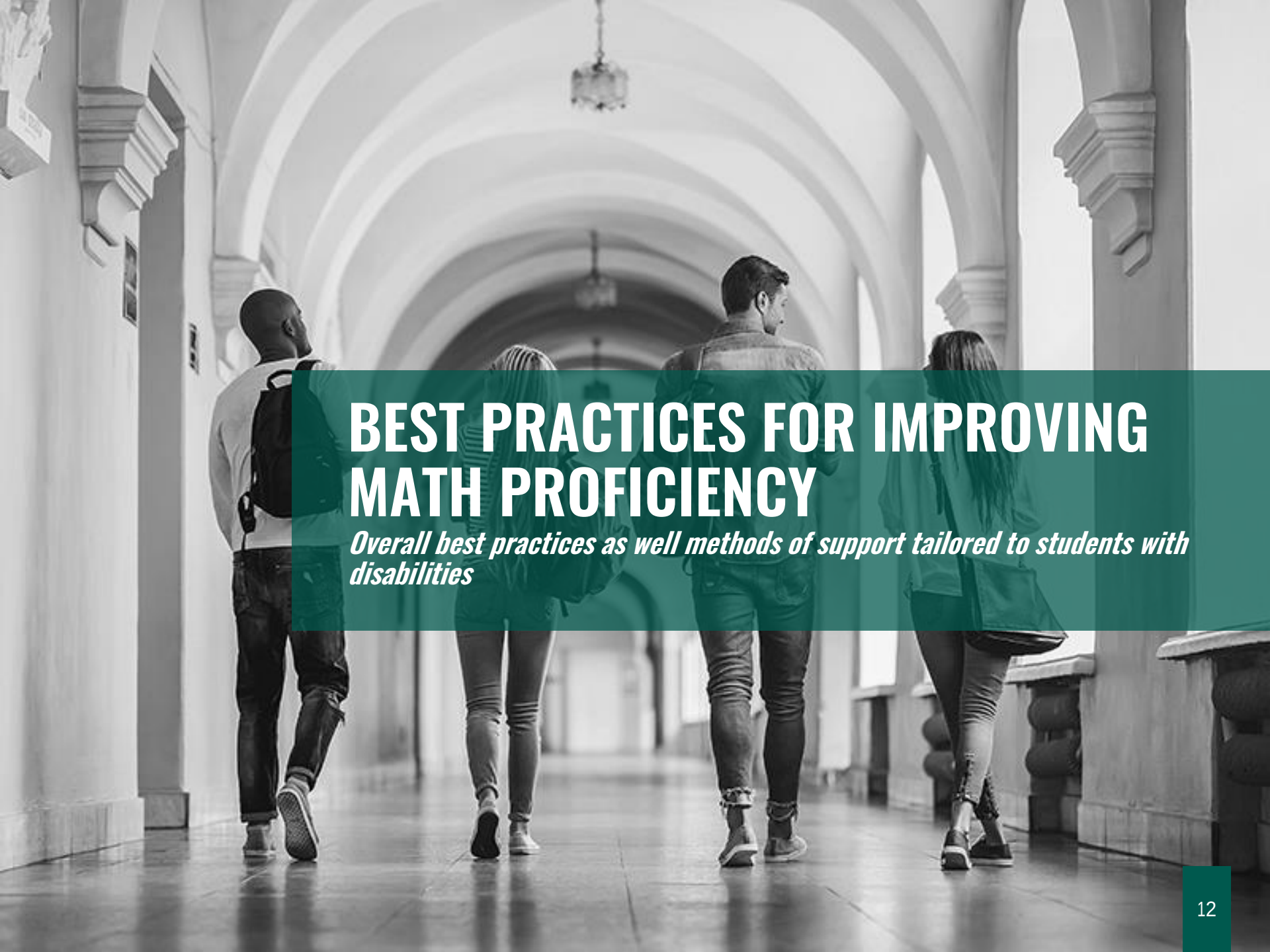


Avg Math Scores

202 264

Highest Scores
- Massachusetts
- Wisconsin
- North Dakota
- Indiana
- Minnesota

Lowest Scores
- Puerto Rico
- West Virginia
- Nevada
- Alabama
- California



BEST PRACTICES FOR IMPROVING MATH PROFICIENCY

Overall best practices as well methods of support tailored to students with disabilities

BEST PRACTICES FOR IMPROVING MATH PROFICIENCY (1/2)

BEST PRACTICES FOR IMPROVING MATH PROFICIENCY

Focusing on best practices for students with disabilities.

Improving math outcomes for all students, and particularly for students with disabilities, requires use of evidence-based practices. These include:

SYSTEMATIC, EXPLICIT INSTRUCTION

Teachers should employ clear, step-by-step instructional methods in math, with frequent checks for understanding and guided practice (Education Northwest). *Explicit instruction* benefits students who struggle by making problem-solving steps transparent. This approach has strong evidence for students with math learning disabilities.

For example, teachers might model how to solve a type of problem out loud ("think-aloud"), use structured examples, and gradually release responsibility to students. Such direct and systematic teaching of mathematical procedures and concepts helps ensure even students with processing difficulties can grasp foundational skills.

PEER-ASSISTED LEARNING AND TUTORING

Peer-assisted instruction is another effective practice. This can take the form of structured peer tutoring or cooperative learning in math (Education Northwest). For instance, classmates might work in pairs on math facts or problem sets, with a higher-performing student guiding a peer, or two students alternating roles as "coach" and "player."

Studies have shown that well-designed peer tutoring programs (e.g., Peer-Assisted Learning Strategies in math) can lead to gains for both tutors and tutees, including students with disabilities, by increasing engagement and providing immediate feedback in a supportive setting. Small-group instruction with a teaching assistant or specialist can also serve a similar role, allowing more individualized attention

VISUAL REPRESENTATIONS AND CONCRETE EXAMPLES

Using manipulatives, visual aids, and drawings to represent mathematical concepts is a proven strategy (Education Northwest). Many students with disabilities learn best when abstract ideas (like fractions or equations) are linked to concrete objects or visuals. Techniques include the concrete-representational-abstract (CRA) sequence, where students first use physical objects (e.g. blocks), then pictures, and finally symbols.

Visualizing math problems through number lines, graphs, or diagrams can improve understanding and problem-solving for struggling learners. Research reviews consistently find that visual representations boost math achievement for students with learning disabilities when combined with explicit teaching.

ONGOING FORMATIVE ASSESSMENT AND RESPONSE TO INTERVENTION

Continuous formative assessment, such as weekly quizzes, exit tickets, or progress-monitoring probes, helps teachers identify when students (or which skills) are falling behind (Education Northwest). Using data, schools can implement Response to Intervention (RTI) or multi-tiered support systems: all students get strong core math instruction, but those who show difficulties are quickly provided with additional, targeted intervention.

The Institute of Education Sciences (IES) practice guide Assisting Students Struggling with Mathematics emphasizes screening all students for math difficulties and providing tiered interventions, such as 20–30 minutes of daily small-group instruction on specific skills, for those at risk. This proactive approach has been effective in boosting elementary and middle school math outcomes when done with fidelity. For students with disabilities, frequent progress monitoring tied to their IEP goals is critical, as it allows teachers to adjust strategies and ensure interventions are yielding improvement.

BEST PRACTICES FOR IMPROVING MATH PROFICIENCY (2/2)

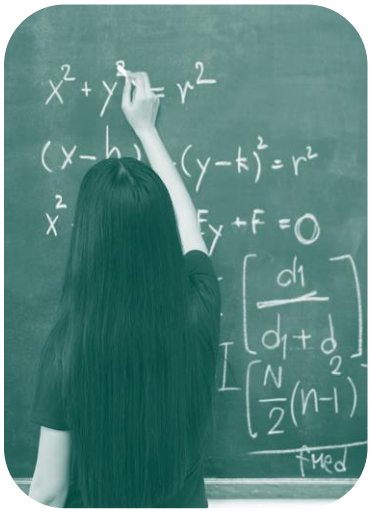
BEST PRACTICES FOR IMPROVING MATH PROFICIENCY

Focusing on best practices for students with disabilities.

METACOGNITIVE STRATEGY INSTRUCTION

Teaching students *how to learn* math, for example, by explicitly instructing them in problem-solving strategies and self-monitoring, is particularly beneficial for students with disabilities. This includes training students in metacognitive strategies like thinking aloud, checking work for errors, and approaching problems systematically (Cook et. al).

One specific evidence-based method is schema-based instruction for word problems, where students are taught to categorize problems by type (e.g., compare, change, combine problems) and apply a consistent solving schema. Reviews have found that schema instruction significantly improves word-problem solving for learners with math difficulties.



Combined with graphic organizers or checklists, strategy instruction helps students become more independent and successful problem solvers (Cook et. al).

INCLUSIVE INSTRUCTIONAL PRACTICES

Research suggests that the quality of core math instruction strongly correlates with outcomes for students with disabilities. This means general education teachers and special educators must collaborate (Education Next). Co-teaching models, wherein a general ed teacher and a special ed teacher jointly plan and teach a math class, can be highly effect effective.

A large-scale study in Massachusetts found that, on average, students with disabilities in co-taught classes improved their math scores by about 2.6 percent of a standard deviation more than similar students in non-co-taught settings (Education Next). While this is a modest gain, it shows that having two teachers (one with content expertise, one with specialized support skills) can benefit students with disabilities without harming non-disabled peers.

Inclusive practice also involves Universal Design for Learning (UDL) principles – planning lessons with multiple means of representation and expression so that diverse learners, including those with disabilities can access the content (CAST). By anticipating learning barriers and scaffolding instruction through the use of manipulatives, audio support for reading in math problems, or accepting alternative ways to demonstrate understanding, teachers can prevent many students from falling behind.

CASE STUDIES

PIEDMONT CITY SCHOOLS – ALABAMA

OVERVIEW

Piedmont City Schools, a rural district in Alabama with approximately 1,100 students, achieved significant improvements in math proficiency during the COVID-19 pandemic. While many districts experienced declines, Piedmont rose from 35th to 12th in state math rankings by 2022, with 57 percent of students reaching proficiency. **The district primarily focused on using data to provide targeted instruction for struggling students.** Additional strategies employed by Piedmont are described below.

Data-Driven Instruction and Analysis

- The district held monthly "data days" where teachers examined student performance on assessments.
- These sessions enabled educators to identify learning gaps and adjust instruction accordingly.

Extended Instructional Time

- Increased time spent on core subjects, especially math and ELA. This was achieved by :
  - Redesigning daily schedule to lengthen math block
  - Prioritizing these subjects during both the regular school day and summer sessions.

Small Group Instruction and Differentiation

- Teachers implemented small-group math instruction, which allowed them to tailor lessons to specific student needs.
- This included students with disabilities, who received more personalized and focused support during these sessions.

Teacher Collaboration and Professional Learning

- Teachers regularly collaborated across grades and departments to share strategies and align curriculum.
- The district emphasized ongoing professional development, particularly in using assessment data to inform instruction.

Early Adoption of Tech and Digital Learning Tools

- Piedmont had invested in 1:1 technology before the pandemic, which made the transition to remote learning smoother and minimized learning loss.
- Teachers used digital platforms to assign practice tailored to students' proficiency levels, including math remediation tools.

Consistent and Stable Leadership

- Piedmont benefitted from strong, stable district leadership that prioritized academic recovery during and after COVID-19 disruptions.
- Leadership emphasized accountability without punitive pressure, focusing instead on growth and progress.

Focus on Foundational Skills

- Instruction focused on deepening understanding of foundational math concepts, especially at the elementary level.
- Students received regular practice in number sense and computation, which laid the groundwork for later success.

Source: The Associated Press

SUCCESSFUL STRATEGIES IN RURAL SCHOOLS

OVERVIEW

A recent study (Lin & Riccomini, 2025) focusing on improving math learning outcomes in rural school districts recommends technology-based instruction that can help bridge the gaps caused by geographic isolation, and further, tend to the needs of students with disabilities. Commonly, teachers use Blocked Practice Format (BPF) to instruct students, which consists of presenting one concept and similar practice exercises in a learning session and then moving onto another concept and practice exercises in a different learning session. Research suggest that Interleaved Practice Format (IPF) can be more effective for students with disabilities and leverages technologies and software platforms such as IXL, KUTA, and ChatGPT. Rather than presenting students with the same type of problem repeatedly, IPF mixes different types of problems to promote cognitive challenge, problem-solving flexibility, and durable learning. For example, a student might be presented with a math question testing subtraction skills, followed by one related to rounding numbers and then one requiring multiplication. This strategy requires no additional funding while simultaneously addressing retention issues faced by students with disabilities.

WHY IPF WORKS: COGNITIVE AND PRACTICAL BENEFITS

Retrieval Practice	Discrimination Practice	Equity and Access
Forces students to recall and apply skills in new contexts, improving long-term retention	Helps students choose the right strategy for different problems, improving problem-solving flexibility	Does not require additional training or high-speed broadband, ideal for rural and under-resourced schools

EVIDENCE FROM RURAL IMPLEMENTATION

In a rural classroom study, ninth-grade students with learning disabilities who used IPF outperformed those who used BPF:

TECH TOOLS FOR DELIVERING IPF IN RURAL DISTRICTS

IX Learning

- Offers adaptive, skill-based math practice aligned with standards.
- Supports **diagnostic feedback**, student progress tracking, and individualized practice.
- Teachers can **design interleaved assessments** by mixing question types and monitoring outcomes automatically.

KUTA Software

- Allows teachers to generate **custom math worksheets** sorted by domain (e.g., algebra, geometry).
- Offers **adjustable difficulty**, multiple question formats (free response/multiple choice), and interleaving via "scramble" function.
- Particularly beneficial for rural educators with limited materials, enabling **offline or print-based IPF delivery.**

ChatGPT

- Provides **AI-generated practice sets** that can be aligned with state standards and adapted for students with disabilities or ELLs.
- Enables **rapid generation** of diverse and leveled math problems with embedded instructional scaffolding.

Source: Lin & Riccomini

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