

# Learning During a Pandemic: How COVID-19 Has Affected Math Outcomes

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## Disclosure

- ▶ Dr. Courtney E. Wheeler and Amy Warnock are employees of Acadience Learning Inc. (ALI).
- ▶ ALI is an educational company that is dedicated to supporting success for children and schools. ALI was founded by Roland H. Good III and Ruth Kaminski, the original authors of the Dynamic Indicators of Basic Early Literacy Skills (DIBELS®)\*. ALI receives revenue from the publication of the assessments in our family of assessments, training and professional development, and the operation of Acadience Learning Online and Acadience Data Management, our data reporting services.
- ▶ Acadience Math is available for free download and photocopying for educational purposes at [acadiencelearning.org](https://www.acadiencelearning.org) and available for purchase from Voyager Sopris Learning® at <https://www.voyagersopris.com/product/assessment/acadience-math/overview>.

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## Agenda

- ▶ Introduction and context
- ▶ Methodology
- ▶ Results
  - ▶ General findings
  - ▶ Case studies - 2<sup>nd</sup> and 5<sup>th</sup> grade
- ▶ Discussion
  - ▶ Implications and next Steps
- ▶ Q & A

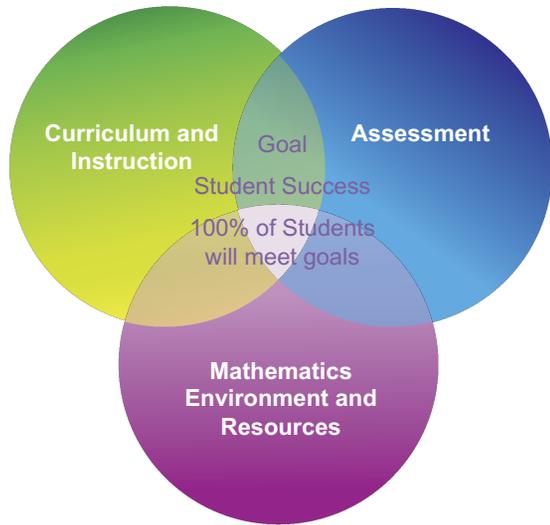


## What Is Acadience Math?

- ▶ A set of measures used to assess mathematics skills for students from kindergarten through sixth grade that can be used to:
  - ▶ Identify students who may be at risk for mathematics difficulties
  - ▶ Help teachers identify areas to target instructional support
  - ▶ Monitor progress of students
  - ▶ Examine the effectiveness of instructional support



## Acadience Math is *One Part* of an Effective School-Wide System



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## Foundations of Acadience Math

- ▶ *Prevention* focus—We CAN change outcomes for students
- ▶ Acadience Math is one part of a *system*
- ▶ Acadience Math is an *indicator*
- ▶ Teach mathematics concepts explicitly and thoroughly
- ▶ Monitor progress *repeatedly and efficiently*
- ▶ Use Acadience Math within an *Outcomes-Driven Model of decision making*
- ▶ *Outcomes* drive instructional change

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## What Is Acadience Math?

### Early Numeracy

- ▶ Beginning Quantity Discrimination
- ▶ Number Identification Fluency
- ▶ Next Number Fluency
- ▶ Advanced Quantity Discrimination
- ▶ Missing Number Fluency

### Computation

### Concepts and Applications

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## Acadience Math is a Set of Indicators



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# Acadience Math Benchmark Goals

## What is a Benchmark Goal?

A research-based target score:

- ▶ Represents the lowest level of performance on a measure that predicts reaching the next benchmark
- ▶ Consists of three parts: a basic mathematics skill, a level of performance, and a point in time
- ▶ If a student achieves a benchmark, the odds are in favor of that student achieving later mathematics outcomes.

How are the Benchmark Goals derived? Based on longitudinal research examining how a score on a measure at a point in time predicts later math outcomes



# Three Levels of Performance Compared to Benchmark Goals

If a student achieves a benchmark goal, the odds are in favor of that student achieving later math outcomes.

- ▶ **Below Benchmark** Odds are generally 40% to 60% of 90% of a child's subsequent benchmark goals and important math outcomes. **Student is likely to need strategic support to make wide effective progress in instruction.**
- ▶ **At Benchmark** Odds are generally 90% to 99% of a child's subsequent benchmark goals and important math outcomes. **Student is likely to need intensive support to make adequate progress.**



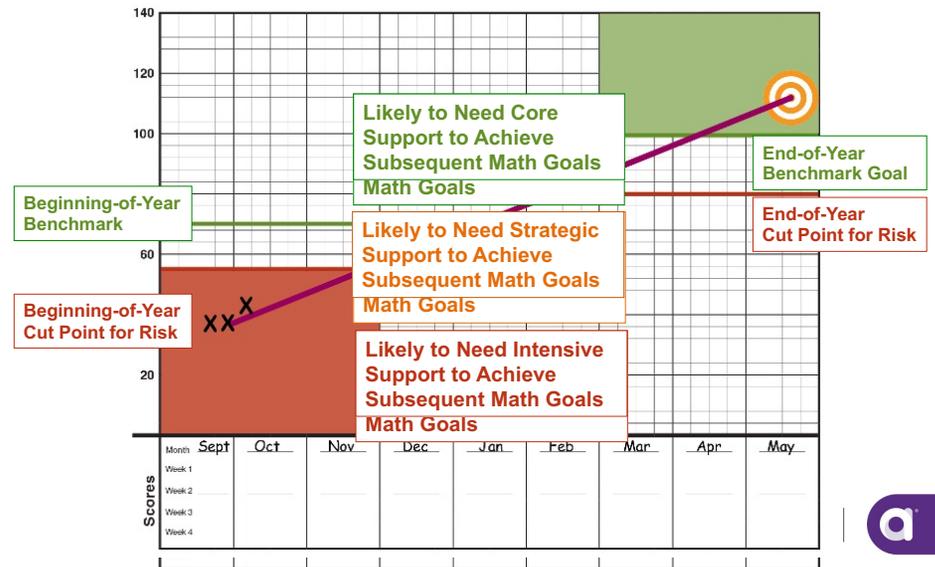
# Math Composite Score

## What is a Composite Score?

- ▶ For each grade and time of year, the measures that correlate highly with later outcomes are combined into a Math Composite Score (MCS).
- ▶ Each measure is weighted so that all contribute approximately equally to the Composite Score.
- ▶ Benchmark goals and cut points for risk are derived for the Composite Score in the same manner as for individual measures.
- ▶ The Composite Score represents a more rich and broad sample of skill than an individual measure.
- ▶ Composite scores may increase or decrease because the number of measures included may vary (e.g. 1<sup>st</sup> grade from fall to winter).



# Benchmark Goals and Need for Support



## COVID-19 Pandemic

- ▶ School closures were implemented during the spring of 2020
  - ▶ Modified instruction or no instruction was occurring for several months, depending on the district
- ▶ Variety of learning modalities, depending on district, occurred in the fall of 2020 (e.g., remote, hybrid, in person)
- ▶ 1.5 billion student's have had schooling disrupted
  - ▶ Largest disruption in history (UNESCO, 2020)
- ▶ The impact on learning from the loss of instruction has been unprecedented

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## Analysis

- ▶ We compared student performance on the Math Composite Score (MCS) between the beginning of 2019–2020 and the beginning of 2020–2021
- ▶ To control for previous performance, we used the middle-of-year MCS from the previous year (2018–2019 or 2019–2020) as a predictor
  - ▶ End-of-year data could not be used due to how few students were assessed at the end of 2019–2020
- ▶ We could not compare beginning of kindergarten because we used previous performance as a predictor. There is no pre-k Acadience Math measure.

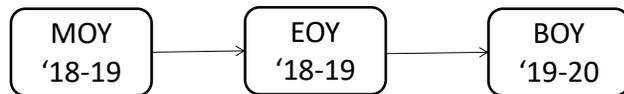
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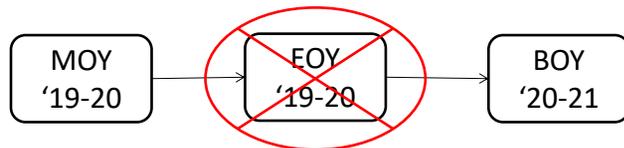
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## Cohorts

Cohort 1  
(18–19 to  
19–20)



Cohort 2  
(19–20 to  
20–21)



Note. MOY = middle of year, EOY = end of year, BOY = beginning of year

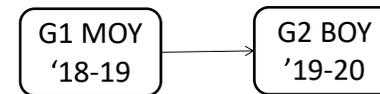
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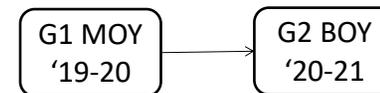
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## Cohorts – Grade 2 Example

Cohort 1  
(18–19 to  
19–20)



Cohort 2  
(19–20 to  
20–21)



Note. MOY = middle of year, EOY = end of year, BOY = beginning of year

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## Participants

- ▶ Data were obtained from Acadience Data Management (ADM)
- ▶ Dataset only included students who had BOY data and MOY data from previous year
- ▶ Schools were matched
  - ▶ If a school did not enter data for a specified grade in both cohorts, data from that school were not included for analysis of that grade span
- ▶ Data were from 389 schools in 191 districts across the US (386 schools, 39 states) and Canada (3 schools, < .5% of the overall sample)



## Sample Sizes

Data Collected for:	Cohort 1 (18–19 to 19–20)	Cohort 2 (19–20 to 20–21)	Total
K & 1	11,236	9,647	20,883
1 & 2	12,860	10,529	23,389
2 & 3	11,819	10,028	21,847
3 & 4	11,288	8,994	20,282
4 & 5	9,582	8,521	18,103
5 & 6	3,092	2,707	5,799

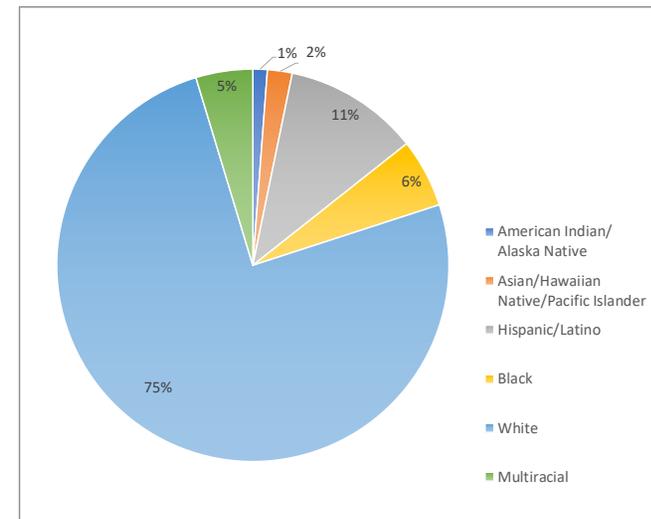


## Student Demographics

- ▶ Demographics, aggregated at the school level, were available from the National Center for Education Statistics (NCES) for 369 of the 389 participating schools
  - ▶ Of the 369 schools, 298 were public and 71 were private
- ▶ Overall, the student population at these schools was 48% female and 39% of students qualified for free or reduced-price lunch



## Student Demographics



Source: Demographic data aggregated at the school level by the U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics (NCES) (<https://nces.ed.gov>) from the 2018–2019 school year (public schools) and the 2017–2018 school year (private schools)



## Findings

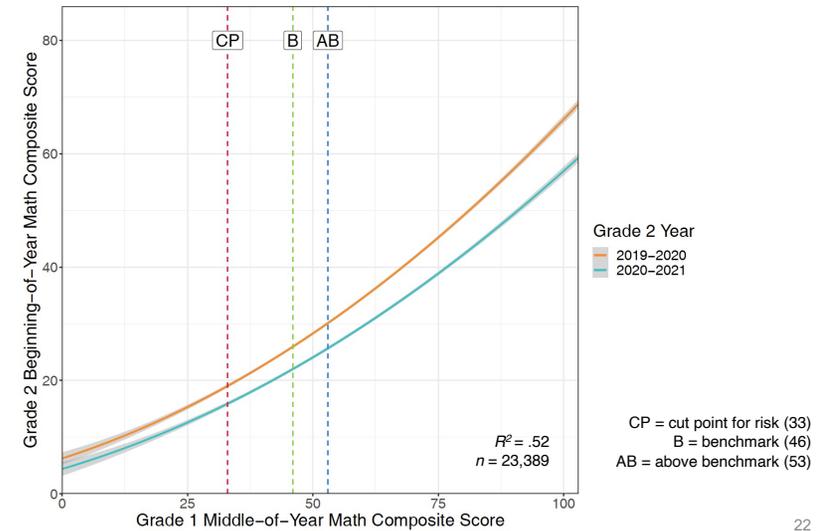
- ▶ Across grades 1–6, students scored significantly lower at the beginning of 2020–2021 compared to the beginning of 2019–2020
  - ▶ Observed this for the MCS and MCS benchmark status (students were less likely to meet the benchmark)
- ▶ In grade 1, the difference between MCS was greater for students with lower initial scores
- ▶ In grades 2–6, the difference between MCS was greater for students with higher initial scores
- ▶ Impacts were larger at upper grades

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## Case Study: Grade 2 BOY MCS, 19–20 vs 20–21

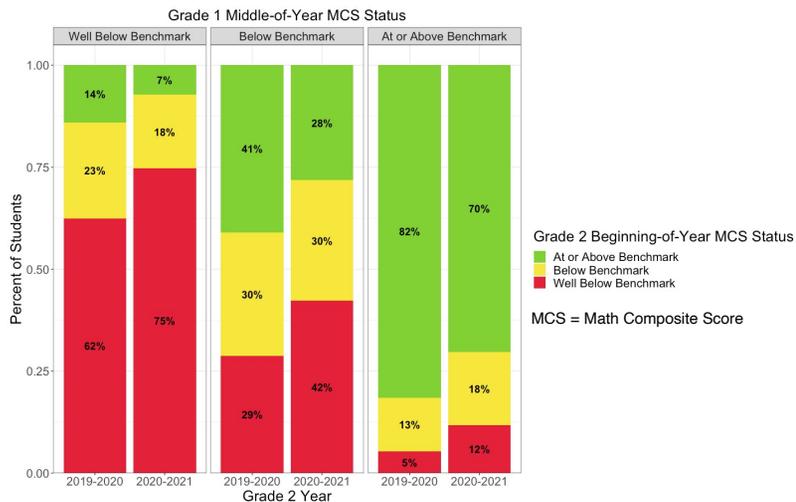


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## Case Study: Grade 2 Likelihood of Meeting Benchmarks

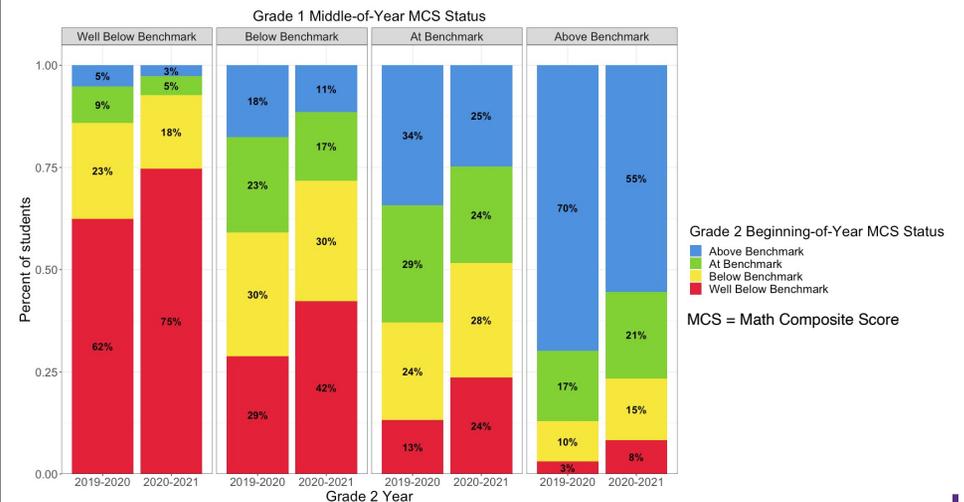


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## Case Study: Grade 2 Likelihood of Meeting Benchmarks

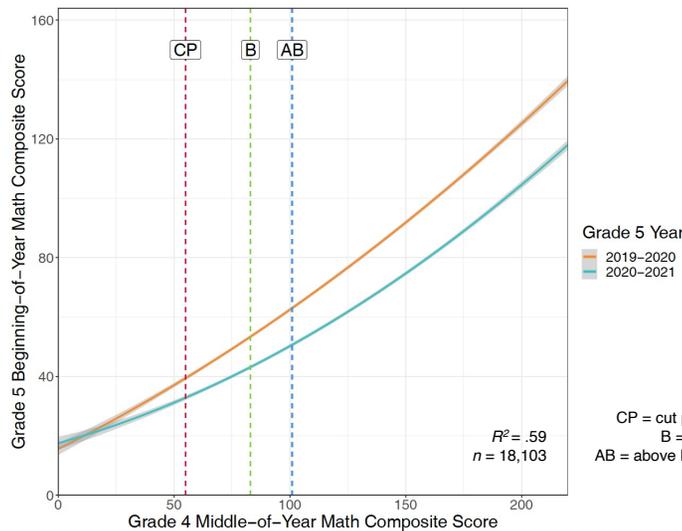


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## Case Study: Grade 5 BOY MCS, 19–20 vs 20–21

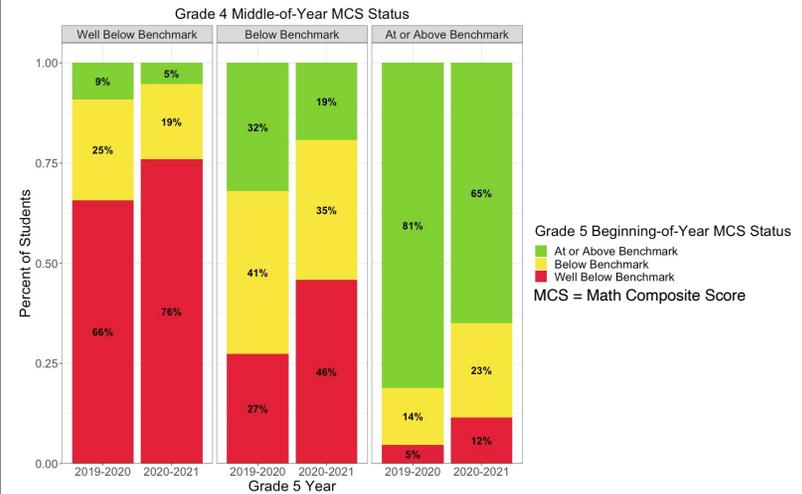


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## Case Study: Grade 5 Likelihood of Meeting Benchmarks

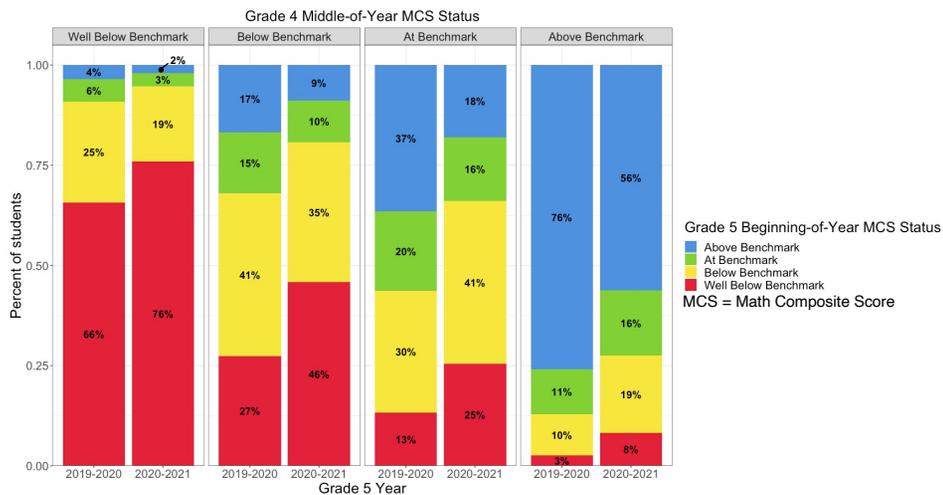


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## Case Study: Grade 5 Likelihood of Meeting Benchmarks



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## Discussion – Implications

- ▶ We know that gaps in skills exist now and will persist in the future, unless we...
- ▶ Focus *assessment* on *indicators* of important *outcomes*.
- ▶ Focus *instruction* on *skills*.
- ▶ *Use* assessment information to *make educational decisions* for individual students and at the system level to *improve outcomes* for all students.

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## How Do We Make Educational Decisions with Acadience Math?

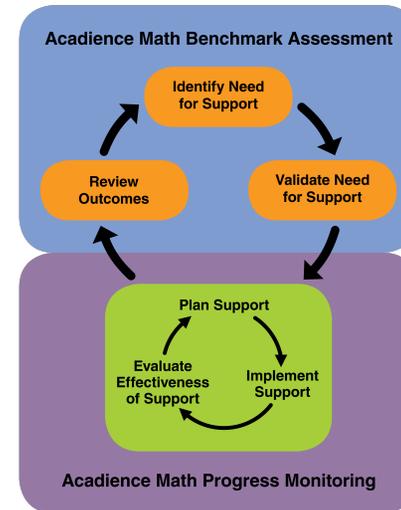
Use within an **Outcomes-Driven Model**: An overarching framework comprised of decision-making steps designed to answer specific questions for specific purposes.

### Outcomes-Driven Model Steps:

1. **Identify** need for support.
2. **Validate** need for support.
3. **Plan** and implement support.
4. **Evaluate** and modify support.
5. **Review** outcomes.



## Outcomes-Driven Model



Within an **Outcomes-Driven Model** in which we:

1. **Identify** need for support
2. **Validate** need for support
3. **Plan** and implement support
4. **Evaluate** and modify support
5. **Review** outcomes



## Outcomes-Driven Model

ODM Step	Questions: Systems	Questions: Student
1. Identify Need for Support	Are there students who may need support? How many students may need support?	Which students may need support?
2. Validate Need for Support	Are we reasonably confident in the accuracy of our data overall?	Are we reasonably confident that the identified students need support?
3. Plan and Implement Support	At what grade levels and/or in what areas may support be needed? What are our system-wide goals? What is our system-wide plan for support?	What are the student's skills and needs? What is the plan of support for the student, including goals and plan for progress monitoring?
4. Evaluate and Modify Support	Are we making progress toward our system-wide goals? Is our system of support effective?	Is each student making adequate progress? Is the support effective for individual students?
5. Review Outcomes	Have we met our system-wide goal? Is our system of support effective? Are there students who may need support? How many students may need support?	Has the support been effective for individual students? Have all students met their individual learning goals? Which students may need support?



## Discussion – Additional Implications

- ▶ Consider instructional context when making decisions about where to intervene. Tier 1 may be most reasonable target.
- ▶ Be thoughtful and reflective when setting goals at the system- and school-levels
- ▶ Consider using the response pattern analysis to help target instruction
- ▶ When making intervention/instructional changes, consider what variables are alterable



## Data Interpretation: Considerations

View data for individual students within the context of the instructional system in the classroom, school, district.

- ▶ If the majority of students in the grade or school are not at or above benchmark or making adequate progress, the solution may need to consider the system.

Data-based decisions are only as good as the data.

- ▶ In order to have data that can be used for making decisions at the district, school, classroom and student levels, accuracy of administration and scoring must be ensured.

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## Pathways of Progress™ for Math

Pathways of Progress for Math adds a normative reference to be used with the Acadience Math benchmarks and helps to set individual learning goals that are ambitious, meaningful, and attainable.

- ▶ Classifies each student's rate of progress as **Well Above Typical**, **Above Typical**, **Typical**, **Below Typical**, or **Well Below Typical**
- ▶ Compared to other students with the same level of initial skills on the Acadience Math Composite Score (MCS)

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## Response Pattern Analysis Example

### Computation / Benchmark 3

Problems	Skills Assessed
1	Add two two- or three-digit numbers, without renaming, resulting in a sum of 1000 or less.
4	Multiply a one-digit number by a one-digit number, resulting in a product of 51 or more.
12	Divide a two-digit dividend by a one-digit divisor, resulting in a one-digit quotient and no remainder.
6	Subtract a two- or three-digit number from a three-digit number, without renaming.
2, 24	Add two four-digit numbers, with renaming from ones to tens, tens to hundreds, and hundreds to thousands.
8, 23	Subtract a three-digit number from a four-digit number, with renaming from tens to ones, hundreds to tens, and thousands to hundreds.
14, 17	Add or subtract two fractions with common denominators. Denominators must be 2, 3, 4, 5, or 10.
7, 18	Add or subtract two fractions with common denominators. Denominators must be 6, 8, 12.
3, 16	Add or subtract two mixed numbers with common denominators. Denominators must be 2, 3, 4, 5, or 10.
10	Add or subtract two mixed numbers with common denominators. Denominators must be 6, 8, or 12.
11, 21	Divide a three-digit dividend by a one-digit divisor, where the divisor evenly goes into the first one or two digits of the dividend, resulting in a quotient and a remainder.
5, 20	Divide a three-digit dividend by a one-digit divisor, where the divisor does not evenly go into the first one or two digits of the dividend, resulting in a quotient and a remainder.
15, 19	Multiply a one-digit number by a three-digit number, with renaming from ones to tens and tens to hundreds.
9, 25	Multiply a two-digit number by a two-digit number, without renaming.
13, 22	Multiply a two-digit number by a two-digit number.

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## Grouping to Instruction: Alterable Elements of Instruction

### Grouping

- Small group instruction
- Homogeneous groups
- Differentiated instruction
- Flexible and dynamic
- Group size

### Time

- How much?
- How frequently?
- When?

### Curriculum Design

- Systematic & sequential
- Integration of skills
- Cumulative review

### Teacher-Student Interactions

- Explicit Instruction
  - Direct explanation
  - Modeling
- High student engagement
  - Lots of opportunities to respond
  - Lots of guided practice with immediate corrective feedback
- Scaffolding to support learning

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## Helpful Resources – Instruction and Intervention

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### Institute of Education Sciences

#### What Works Clearinghouse™ Practice Guides:

- ▶ Assisting Students Struggling with Mathematics: Intervention in the Elementary Grades (<https://ies.ed.gov/ncee/wwc/PracticeGuide/26>)
- ▶ Assisting Students Struggling with Mathematics: Intervention in the Elementary Grades: Response to Intervention (RtI) for Elementary and Middle Schools (<https://ies.ed.gov/ncee/wwc/PracticeGuide/2>)
- ▶ Developing Effective Fractions Instruction for Kindergarten Through 8<sup>th</sup> Grade (<https://ies.ed.gov/ncee/wwc/PracticeGuide/15>)
- ▶ Improving Mathematical Problem Solving in Grades 4 Through 8 (<https://ies.ed.gov/ncee/wwc/PracticeGuide/16>)
- ▶ Teaching Math to Young Children (<https://ies.ed.gov/ncee/wwc/PracticeGuide/18>)

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## Helpful Resources – Instruction and Intervention

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### National Center on Intensive Intervention

- ▶ Intensive Intervention in Mathematics Course Content (<https://intensiveintervention.org/intensive-intervention-math-course>)
- ▶ Mathematics Strategies to Support Intensifying Interventions (<https://intensiveintervention.org/intervention-resources/mathematics-strategies-support-intensifying-interventions>)

### Information on Explicit Instruction

- ▶ <https://explicitinstruction.org/>

### Information on using data to inform instruction

- ▶ <http://www.acadiencelearning.org/training/>

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## Discussion – Next Steps in Our Research

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- ▶ Examine school-level factors
- ▶ Examine state-level differences
- ▶ Examine characteristics of schools that didn't collect data (i.e., attrition)
- ▶ Examine middle-of-year data
- ▶ Examine the role of administration (e.g., in person vs. remote)



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## Conclusions

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- ▶ We found a large impact on students' math skill development at all grades. The effect tended to be the greatest at the high end of the performance spectrum and smallest at the low end.
- ▶ Despite concerning findings, educators have tools at their disposal for:
  - ▶ gauging students' skills
  - ▶ setting meaningful, ambitious, and attainable goals,
  - ▶ using evidence-based instructional practices, and
  - ▶ tracking student progress toward important educational outcomes and adjusting instruction when needed.
- ▶ Federal funding is available to schools to support efforts to address learning losses related to the pandemic (e.g., summer or after-school programs, assessments, instructional resources, technology).

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## Funding Resources

- ▶ U.S. Department of Education COVID-19 Resources for Schools Students and Families
  - ▶ <https://www.ed.gov/coronavirus>
- ▶ Federal Funding Information
  - ▶ <https://oese.ed.gov/offices/education-stabilization-fund/elementary-secondary-school-emergency-relief-fund/>

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## Questions

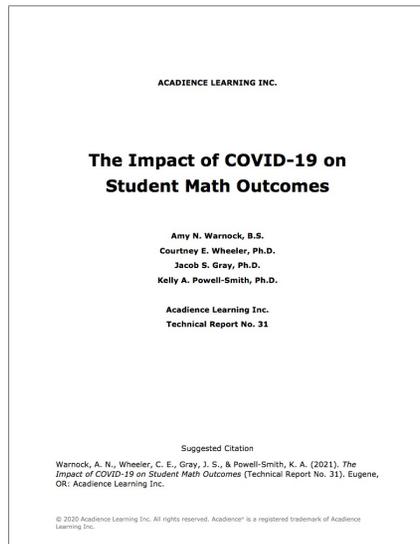


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## Read Our Technical Brief

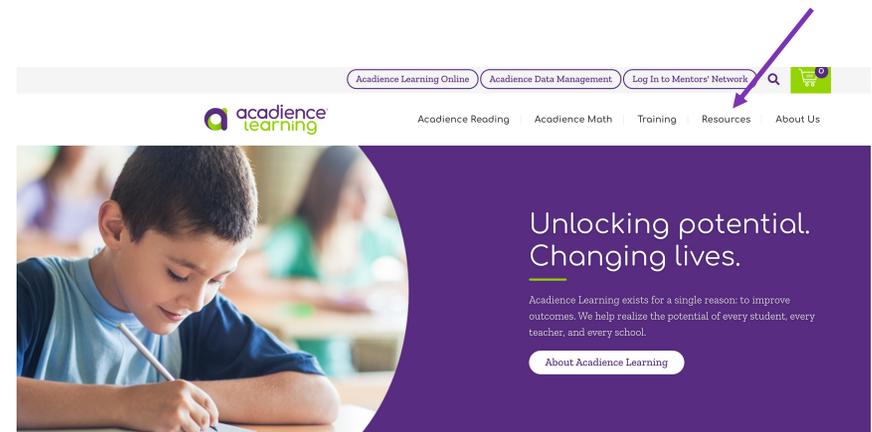


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## Read Our Technical Brief

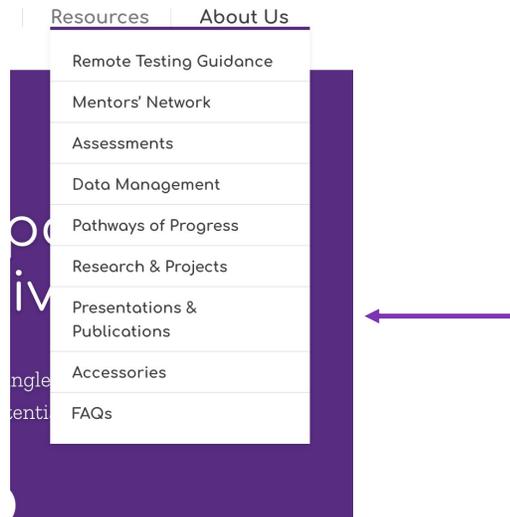


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## Read Our Technical Brief



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