Catching Up and Moving Forward

Accelerating Math Learning for Every Student
Executive Summary

Across the nation, while many people have returned to their normal routines, the impact of the COVID-19 pandemic on math learning persists. After enduring more than two years of pandemic disruptions, each student’s learning has been affected differently. Teachers need practical ways to help kids catch up and move forward in math. As a nonprofit educational organization with the largest dataset on student math learning in the nation, Zearn is in a unique position to investigate this further.

When the 2020–2021 school year began, teachers had a tough decision to make. They could either go back and redo the months of disrupted work or move forward with the next grade’s work with some built-in review. In partnership with TNTP, Zearn’s researchers investigated the impact of these classroom-wide decisions in fall of 2020. Researchers found that classes that followed a learning acceleration approach struggled less and learned more than those that took a remediation approach.

Today, however, teachers are contending with more than two years of varied learning disruptions. Each student will need ongoing and wide-ranging support throughout the year. Knowing that, what strategies will most effectively catch up students each time they struggle in math?

Two strategies are typically used to address student struggle in math. One is remediation where students practice skills they did not master during previous grades, which are often identified by a diagnostic or pre-unit assessment tool. The other strategy is learning acceleration, which begins with grade-level learning. When learning gaps arise, students engage in just-in-time foundational support connected to the grade-level content they are learning.

The research looked at how 600,000 individual elementary- and middle-school students across all 50 states responded to 5 million instances of learning acceleration and remediation in the 2020-2021 and 2021-2022 school years. Researchers found that when a student is consistently accelerated, they complete twice the amount of grade-level lessons over the course of the year when compared to a student who was frequently remediated.

More specifically, researchers found:

▶ a student struggled 17% less in math when they experienced learning acceleration vs. when they were remediated.
▶ a student that experienced consistent learning acceleration completed twice as many grade-level lessons over the course of the year when compared to a student who was frequently remediated.
▶ a student enrolled in a majority Black, Latino or low-income school was more likely to be remediated when compared with their white and high-income peers – even when they already demonstrated the same level of success with grade-level work.
▶ a student enrolled in a majority Black, Latino or low-income schools struggled 19% less in math when they experienced learning acceleration.

While many factors influence student achievement in math, one factor is clear: learning acceleration helps students struggle less and learn more. As the nation works collectively to help all students get back on track, this research study provides encouraging evidence that learning acceleration can help all students catch up and move forward. In preparation for the 2022-2023 academic year, leaders must provide teachers with the tools and the training to make learning acceleration available to all kids.
**Methodology**

Zearn is a nonprofit educational organization behind the top-rated math learning platform used by 1 in 4 elementary-school students and 1 million middle-school students nationwide. Zearn has data from millions of K-8 students, across all 50 states, who have completed more than 11 billion math problems. This offers researchers a robust view of student math learning nationwide.

In this study, researchers examined every instance of when a student repeatedly struggled* with math and how their teacher responded — through a remediation or learning acceleration approach.

In total, researchers analyzed more than 5 million teacher instructional decisions made for more than 600,000 students, representing all 50 states, in first through seventh grades, during the 2020-2021 and 2021-2022 academic years. To do this, researchers:

- utilized a quasi-experimental design.¹ They looked at the same student, multiple times over the course of two years. Based on the instructional decision, they determined how likely a student was to struggle on the next grade-level lesson.
- categorized instructional decisions as either learning acceleration or remediation, based on what content teachers assigned in response to student struggle. Learning acceleration occurred when a teacher assigned a small amount of foundational math work that was closely connected to what a student is learning in that grade. In contrast, with remediation, students were assigned prior grade-level work that was not connected with their current math learning.²
- analyzed how many grade-level lessons a student completed relative to how often they were remediated versus experienced learning acceleration.
- used school-level demographic information (race/ethnicity, income status) to signal how often a specific group of students (ex. low-income versus high-income students) experienced remediation versus learning acceleration.

For a more detailed methodology, view the technical appendix.

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¹ Findings are based on a quasi-experimental, fixed-effect, logistic regression model. Quasi-experimental research methods aim to mimic randomized trials in controlling for confounding variables to focus on potential causal relationships between a decision and an outcome. Researchers compared the frequency with which a student continued to struggle on the next grade-level lesson immediately following an instance of remediation versus acceleration. By averaging the impact of each intervention across over 5 million instances and for each of the 600,000 students, researchers generated the probability of continued struggle.

² Researchers categorized “learning acceleration” or “remediation” based on the specific content teachers assigned in response to student struggle. In the 2020-21 academic year, Zearn introduced Foundational Lesson Guidance, foundational lessons that are coherently connected to the grade-level content that students are learning. Learning acceleration occurred when students repeatedly struggled and were assigned these lesson recommendations and/or when students progressed to the next grade-level lesson after receiving built-in learning acceleration support. Remediation occurred when students repeatedly struggled and were assigned lessons that were below grade-level and isolated from grade-appropriate learning.
Findings

FINDING 1 A student struggled 17% less in math when they experienced learning acceleration versus when they were remediated. Further, when a student was consistently assigned learning acceleration they completed twice as many grade-level lessons as those students who were remediated.

FINDING 2 Researchers also found that when a student experiences consistent learning acceleration, they complete twice as many grade-level lessons over the course of the year when compared to a student who was frequently remediated.3

FINDING 3 A student enrolled in a majority Black, Latino or low-income school was more likely to be remediated when compared with their white and high-income peers — even when they already demonstrated the same level of success with grade-level work.

3 Researchers categorized students based on the type of content – remediation or learning acceleration – they were assigned over the course of the academic year. Zearn has multiple layers of built-in learning acceleration content. A student who gets any question wrong automatically receives built-in learning acceleration content. This content supports the student who is struggling. If a student continues to struggle and needs additional support, the Zearn platform recommends foundational lessons that also follow a learning acceleration approach.

A student is categorized as “frequently remediated” if they are assigned remediation content by a teacher more than 10% of the time in response to repeated struggle. Given the multiple ways learning acceleration content is offered on Zearn and the notion that a teacher must bypass this content, 10% is a meaningful cutoff for defining frequent remediation.
For every student in the 600,000 student cohort, researchers analyzed the extent to which a student repeatedly struggled on grade-level lessons. Students were grouped into similar levels of repeated struggle — which serves as a proxy for the student’s success with grade-level content. Figure 2 represents what percentage of students were remediated, for students in the lowest group of struggle.

FINDING 4  A student enrolled in a majority Black, Latino or low-income school struggled 19% less in math when they experienced learning acceleration.

The findings are striking for students who had demonstrated the same level of success with grade-level work. As Figure 2 shows, only 9% of students in majority white schools were remediated. In contrast, 16% of students in majority Black and Latino schools were remediated. This same trend was observed between high-income (8%) and low-income schools (15%).

FINDING 4  A student enrolled in a majority Black, Latino or low-income school struggled 19% less in math when they experienced learning acceleration.

Percent of students demonstrating success with grade-level content who are assigned remediation content in response to struggle, by student subgroup

<table>
<thead>
<tr>
<th>Students enrolled in schools serving primarily:</th>
<th>% remediated</th>
</tr>
</thead>
<tbody>
<tr>
<td>White students</td>
<td>9%</td>
</tr>
<tr>
<td>Black and Latino students</td>
<td>15%</td>
</tr>
<tr>
<td>Students from high-income backgrounds</td>
<td>8%</td>
</tr>
<tr>
<td>Students from low-income backgrounds</td>
<td>15%</td>
</tr>
</tbody>
</table>

% remediated: White students (9%), Black and Latino students (15%), Students from high-income backgrounds (8%), Students from low-income backgrounds (15%).

Percent likelihood that a student repeatedly struggles in grade-level math after receiving an intervention, by intervention approach and student subgroup

<table>
<thead>
<tr>
<th>Intervention approach and student subgroup</th>
<th>Likelihood of repeated struggle on next grade-level lesson</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remediation</td>
<td>All students: 44%, Students enrolled in low-income schools: 51%, Students enrolled in majority Black and Latino schools: 59%</td>
</tr>
<tr>
<td>Acceleration</td>
<td>All students: 36%, Students enrolled in low-income schools: 41%, Students enrolled in majority Black and Latino schools: 41%</td>
</tr>
</tbody>
</table>

19% reduction in struggle

17% reduction in struggle

19% reduction in struggle

1 For every student in the 600,000 student cohort, researchers analyzed the extent to which a student repeatedly struggled on grade-level lessons. Students were grouped into similar levels of repeated struggle — which serves as a proxy for the student’s success with grade-level content. Figure 2 represents what percentage of students were remediated, for students in the lowest group of struggle.

2 Based on school-level percentages of students eligible for free or reduced-price lunches (FRL). Low-income defined as those with 75%+ of students FRL-eligible. High-income defined as <40% of students FRL-eligible.
While instructional decisions have not been equal, the positive impact of learning acceleration is consistent across student subgroups. In fact, learning acceleration, relative to remediation, is consistently beneficial for students in majority Black, Latino and low-income schools (see Figure 3). When a struggling student in a majority Black or Latino school was assigned learning acceleration they struggled 19% less than when they were remediated.

Each of these findings are in line with those in the initial TNTP/Zearn report. No matter a student’s background, remediation appears to cause students to struggle more and learn less when compared with learning acceleration. A striking conclusion against the backdrop of more than two years of unfinished learning.

**Learning Acceleration in Practice**

While the data provides strong evidence that learning acceleration is the most effective strategy, what does this look like in practice?

Take a fifth-grade math classroom. Students are asked to solve this problem:
What is two divided by one half?

![Fifth grade division of fractions problem](image)

The question assumes students can use what they learned about division and fractions in prior grades. Yet, students may not have a full understanding of this concept.

Before moving on with grade-level work, a remediation approach would require students to complete a lengthy, prerequisite review of content from prior grades. For example, students might practice adding and subtracting fractions, a significant component of students’ fourth grade learning. Unfortunately, this practice will not help students understand this division of fractions problem.

A better way forward exists.

When students begin to struggle with this problem, imagine that students would complete a quick review of a third-grade lesson. In this targeted lesson, students use visual representations to deepen their understanding of division. Rather than dividing fractions, students divide whole numbers. They start with a real-life scenario to promote understanding.
**Third grade division problem**

Mrs. Joseph has 2 pounds of tomatoes. If she puts 1 pound into each bowl, how many bowls will she use?

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**Third-grade division lesson used to support fifth-grade learning**

Students draw a tape diagram. They partition the tape into 1-pound units. Students can see they have made two equal groups. Students can then solve the problem for the unknown factor.

When learning with Zearn, students explore math through pictures, visual models and real-life examples. Thus, students start by representing their thinking by drawing a picture (see Figure 4). This helps them understand the known parts of the problem: the total amount of tomatoes and size of each group of tomatoes. This visual representation helps students make sense of the math. From here, students can relate the unknown factor (the number of bowls) to the number of groups. They can even count to solve; Mrs. Joseph will use two bowls.

Using the context of the problem and pictures, students can solve the third-grade problem. This third-grade work acts as a bridge between understanding of division and understanding of division of fractions.

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**Fifth-grade division of fractions lesson using strategies learned in third grade acceleration lesson**

Students draw a tape diagram. They partition the tape into 1/2 pound units. Students see that they have made four equal groups. Students can then solve the problem for the unknown factor.
Students return to their fifth-grade math equipped with an entry point to the problem (see Figure 5). They still have 2 pounds of tomatoes. This time, they need to put a 1/2-pound in each bowl. Students can solve the fifth-grade problem the same way they solved the third-grade problem. This new learning is a logical extension of work students have been doing all along.

They draw a picture of the tomatoes again. Then they draw their tape diagram and partition the drawing into 1/2-pound units. They see they have made four equal groups. Solving for the unknown factor — the number of bowls — they can use their drawing to see they need four bowls.

This is learning acceleration in action.

Learning acceleration integrates unfinished learning — in this case, division — into the context of new learning, so students make connections and move forward.

Recommendations

Since the start of the pandemic, Zearn researchers have tracked student struggle. The findings have been consistent overtime: learning acceleration appears to be a very effective strategy to enhance math learning.

The time to embrace this strategy is now. The Elementary and Secondary School Emergency Relief (ESSER) Fund will not last forever. School districts and states must act and utilize this historic investment to ensure all kid — no matter their background — can catch up and move forward with math. All kids are math kids.

As the teachers and students prepare to return to the classroom and commence the 2022-2023 academic year, leaders must:

Select core instructional materials that help teachers implement learning acceleration.

States and districts tasked with selecting high-quality instructional materials have a dizzying array of choices of varying quality. The best instructional materials for core curriculum are not only high-quality but also provide suggestions for coherent, in-the-moment support to a student who is struggling. Teachers simply don’t have enough time to identify all the material from prior grades that each individual student needs. States and districts must choose curriculum publishers that provide guidance to help teachers make learning acceleration a part of their daily math instruction.
Choose technology built for learning acceleration, not remediation.

A majority of educators and administrators surveyed in EdWeek said they plan to buy digital resources to help students who have fallen behind in math. To assess educational technology, EdWeek suggests educators should find out what happens in a particular platform when a student struggles in math.

Educators should look for platforms, like Zearn, that focus on grade-level learning for all students. Technology designed for learning acceleration also embeds diagnostics into daily student learning. These daily diagnostics assess each student’s understanding at the lesson-level. Further, the best technologies use the assessment data to automatically launch real-time support students need, exactly when they need it.

In contrast, technology designed for remediation often focuses on personalized playlists that review concepts from prior grades, often based on a one-time assessment. Often students spend most of their time skill building, rather than building deep understanding of concepts.

For example, in the division of fractions example above, technology designed for remediation might suggest that students complete a series of practice problems focused on adding fractions as a prerequisite skill. As described, this does not help students with division of fractions. This is why it is imperative that districts and schools choose technology built for learning acceleration, not remediation.

Offer additional, high-impact instructional time to students who are struggling with math.

States and districts have great flexibility in how they choose to help students who are struggling in math. They can do this through extra instructional time such as tutoring or summer school. To do this effectively, states must offer scalable programs that align with what students are learning in the classroom; utilize high-quality materials, which allow students to consistently engage with one fundamental math concept at a time; and offer real-time, progress monitoring. Data must be utilized to continuously improve: to identify what is and isn’t working and to effectively communicate what needs to change to best support students’ learning.
Provide teachers with comprehensive and ongoing professional development to facilitate learning acceleration.

Even before the pandemic, meeting students’ various learning needs was challenging. With the heightened pressure brought on by the pandemic, it is critical to ensure that the focus of professional development is on exploring teaching strategies for every math concept students will be learning. This helps teachers identify opportunities to make connections with math concepts across grade levels and more precisely identify, interpret and address student struggle. The most effective professional learning programs offer this ongoing, collaborative exploration of the math content students are learning.

When teachers have access to tools to build math content knowledge, they can focus on learning acceleration approaches, instead of finding and developing resources.

Recommendations In Action

Some states and districts have embraced these recommendations and made learning acceleration a reality for all students. For example, the Tennessee Department of Education (TDOE) is supporting teachers through the TN All Corps, a nationally recognized tutoring model endorsed by the Center for Education Policy Research at Harvard University. As a part of the program, teachers are provided with the tools and training to ensure students catch up with math. Zearn is provided at no cost, through the conclusion of the 2023-2024 academic year, to districts engaged in the TN All Corps. Utilizing Zearn lessons, teachers have helped more than 85,000 elementary and middle school students accelerate their math learning.

A similar program is available to Texas students. The Texas Education Agency funded an initiative to provide high-impact tutoring for 1 million students, making it the first in the nation to provide subsidized, evidence-based tutoring for schools and districts statewide at scale. More than 40,000 Texas elementary and middle school students engaged in the Vetted Texas Tutor Corps (VTTC) have accelerated their math learning. Zearn was selected by the Texas Educational Agency as the sole subsidized provider of high-quality math tutoring content for VTTC.

Finally, the Massachusetts Department of Education is providing guidance and free access to vetted high-quality curricula and engaging and interactive digital instructional materials and learning programs like Zearn.

Zearn is the 501(c)(3) nonprofit educational organization behind Zearn Math, the top-rated math learning platform used by 1 in 4 elementary-school students and 1 million middle-school students nationwide. Everything we do is driven by the belief that every kid is a math kid. Learn more at about.zearn.org.

Privacy Statement

Zearn uses aggregated and anonymized learning data to improve kids’ math learning experiences. For more information on how we protect student privacy, visit about.zearn.org/privacy.