ACCELERATE, DON'T REMEDIATE:

New Evidence from Elementary Math Classrooms

Introduction

With the COVID-19 pandemic waning, school systems are shifting their focus from surviving the crisis to helping students recover from the social, emotional, and academic toll of the most significant disruption to K-12 education in history. That process will take years—but the choices system leaders make over the next few months as they plan for the 2021-22 school year will be crucial.

On the academic front, one choice looms especially large. Research suggests more students have experienced more unfinished learning over the last year than ever before. How should schools help them get back to grade level—and back on track to pursue their goals after high school?

The most common approach is what's known as *remediation*, or assigning work better suited for earlier grades. For example, at the beginning of third grade, a teacher would review all second-grade content the students missed before moving on to third-grade work. It's an intuitive strategy, and one that many teachers have been told to use throughout their careers, starting in teacher preparation programs. However, our own pre-pandemic research showed that it can actually hurt students and exacerbate racial inequities.

Over the past year, an alternative has gained traction across the country: *learning acceleration*. In this approach, the fourth-grade teacher starts with fourth-grade content, and strategically builds in key third-grade concepts when students might need them to master the grade-level work. This "just-in-time teaching" ensures students spend more time on the work of their grade—the key to ultimately catching up.

New data from Zearn, a nonprofit organization whose online math platform is used by one in four elementary students nationwide, provides one of the first direct comparisons of these two approaches—and compelling new evidence that school systems should make learning acceleration the foundation of their academic strategies next year and beyond.

Our work with Zearn uncovered striking findings. An analysis of data from Zearn encompassing more than two million students in more than 100,000 elementary math classrooms[1] shows:

- Students who experienced learning acceleration struggled less and learned more than students who started at the same level but experienced remediation instead.
- Students of color and those from low-income backgrounds were more likely than their white, wealthier peers to experience remediation—even when they had already demonstrated success on grade-level content.
- Learning acceleration was particularly effective for students of color and those from low-income families.

Put simply, this data provides strong evidence that learning acceleration works, and that it could be key to unwinding generations-old academic inequities the COVID-19 pandemic has only exacerbated. As we found in *The Opportunity Myth,* all students can succeed when given a chance to do grade-level work—and that students of color and low-income students are most likely to be denied those opportunities. System leaders have an important opportunity in the months ahead to start providing teachers with the resources and support they need—and to start building the skill and belief that's necessary—to help every student engage in grade-level work right away.

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[1] To better understand the effectiveness of learning acceleration vs. remediation, some of the findings below are based on a subset of 3rd – 5th grade students who missed key content last year (N = approximately 6,000 classrooms and 50,000 students). See the Methodology section below for more details.

Methodology

This analysis is informed by aggregated data from over 100,000 classrooms and over 2 million students who used Zearn's K-5 online math platform during the 2020-21 school year—approximately 10% of the total elementary public school enrollment nationwide.[2] Zearn identified more than 6,000 third-, fourth-, and fifth-grade classrooms serving more than 50,000 students who, because of school closures, missed an entire section of critical math content during the 2019-2020 school year, and had at least three years of historical, continuous Zearn usage to allow for analyzing trends over time. In response to these missed learning opportunities, Zearn published revised scope and sequences prior to the start of the 2020-21 school year to help teachers use the platform to implement a learning acceleration strategy. Some teachers ultimately followed these new scope and sequences, while others opted for traditional remediation by starting with other, less-connected below-grade-level content—essentially beginning their instruction wherever students left off when schools closed in the 2019-20 school year. This created a natural experiment to compare the effectiveness of remediation to that of learning acceleration.

REMEDIATION *Spending significant time in below-grade level content before moving into new learning*	ACCELERATION *Connecting unfinished learning into the context of new learning*
..... covering many objectives or standards from prior grades/units (usually extending to a month or more of instruction)	.... integrating a few lessons from prior grades/units
.... isolated from grade-appropriate learning	.... Just-in-time to grade-appropriate learning (whether in core or extended time)
.... usually with greater than 50% of time on procedural fluency	.... always with an appropriate balance of fluency, conceptual understanding, and application work *See Appendix for a detailed example*

Zearn compared the results of students in identified 3rd-5th grade classrooms who experienced remediation with those who experienced learning acceleration during the 2020-21 school year, focusing on:

- The extent to which they struggled with grade-level content—as measured by the alerts Zearn automatically generates when students repeatedly answer questions incorrectly[3]—relative to how those same students struggled prior to the pandemic.
- The number of grade-level lessons they completed during the 2020-21 school year.
- The connection between below-grade content and what students were focused on in grade-level lessons.

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[2] The findings of this report are based on de-identified and aggregated usage data collected by Zearn in accordance with its Privacy Policy and school and district partner agreements. No protected student data was utilized or disclosed in connection with the preparation of this report or its findings.

[3]As students complete Zearn digital lessons, an embedded daily diagnostic assesses each student's understanding. When a student answers incorrectly, the program automatically provides additional support and scaffolding from prior grades or prior units; this is called a "Boost." Students are then given a new problem to demonstrate understanding. If a student continues to struggle after multiple Boosts, the teacher receives an alert. In this analysis, only alerts that show repeated struggle on grade-level lessons are included, referenced throughout this paper as "repeated struggle alerts."
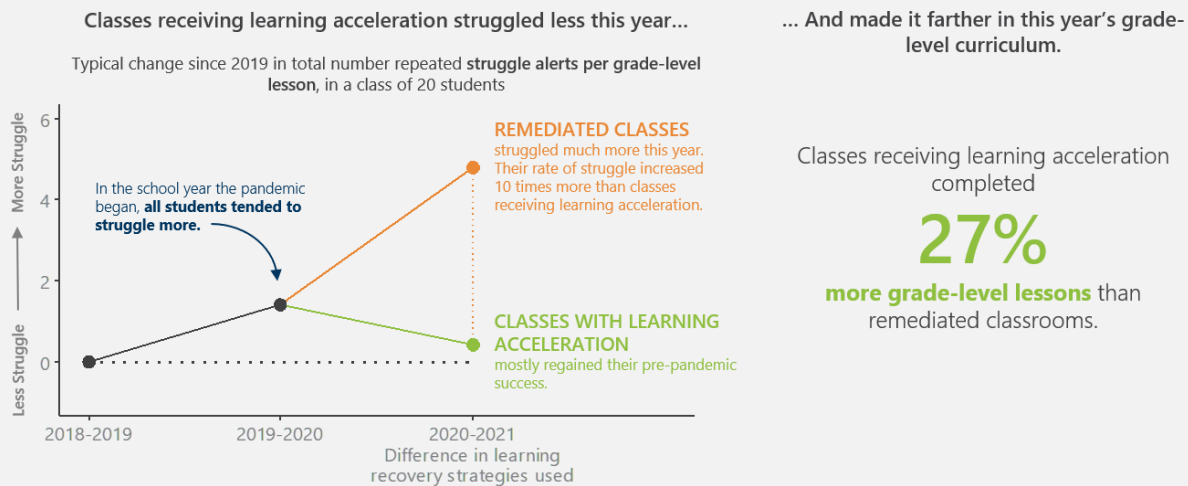
Findings

Students who experienced learning acceleration struggled less and learned more than students who started at the same level but experienced remediation instead.

For many classrooms using Zearn, the pandemic brought an abrupt halt to schooling, and students missed entire sections of grade-level content in 2019-2020. Leading up to the pandemic, these classes' rates of struggle were similar and trended in similar directions[4]. But their results this year diverged significantly. Classes that experienced remediation in their new grade this year struggled on their grade-level content significantly more than classes that experienced learning acceleration. This is particularly notable because the intent of remediation is to avoid struggle by presenting students with content that they've seen before. Our findings suggest that a remediation-based approach results in even more struggle (see Figure 1).

But it wasn't just that the classes that experienced learning acceleration struggled less. They also completed 27% more grade-level lessons. In fact, students in those classes mostly regained their pre-pandemic success on grade-level mathematics despite all the interruptions of the past year.[5]

FIGURE 1 | Effectiveness of Learning Acceleration vs. Remediation

Classes receiving learning acceleration struggled less this year...

Typical change since 2019 in total number repeated **struggle alerts per grade-level lesson**, in a class of 20 students

More Struggle / Less Struggle (y-axis)

In the school year the pandemic began, **all students tended to struggle more.**

REMEDIATED CLASSES struggled much more this year. Their rate of struggle increased 10 times more than classes receiving learning acceleration.

CLASSES WITH LEARNING ACCELERATION mostly regained their pre-pandemic success.

2018-2019   2019-2020   2020-2021
Difference in learning recovery strategies used

... And made it farther in this year's grade-level curriculum.

Classes receiving learning acceleration completed

27%

more grade-level lessons than remediated classrooms.

SOURCE: N = 27,926 students / 3,742 classrooms for the remediated group. N = 22,713 students / 2,337 classrooms for the learning acceleration group. Zearn data drawn from 3rd, 4th, and 5th grade classrooms in school grades that missed the final set of lessons of previous school year with sufficient student activity and 3+ years of continuous data.

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[4] For example, in 2018-2019, classrooms that would eventually receive learning acceleration in 2020-2021 had 10.2 repeated struggle alerts per lesson for a typical class of 20, while this rate was 9.2 for classes that would eventually be remediated in 2020-2021. Both class types increased their repeated struggle alerts by 1.4 in 2019-2020.

[5] See Figure 1. In this analysis, only repeated struggle alerts from grade-level lessons are included. In 2018-2019, classrooms in the remediation group tended to struggle slightly less than classes in the learning acceleration group, with 9.2 struggle alerts (in a class of 20) per lesson to 10.2, respectively. Differences in the amount of repeated struggle alerts generated by the two class types were tested with a linear regression-based difference-in-difference model. The difference in 2019 to 2021 changes in total repeated struggle alerts per lesson was 4.42 for a class of 20 students, which was significantly different from 0 at the $p < 0.001$ level. Percent increase in grade-level lessons completed was calculated by subtracting the mean number of grade-level lessons completed in remediated classrooms from the mean number of grade-level lessons completed in learning acceleration classrooms and then dividing that difference by the mean number of grade-level lessons completed in remediated classrooms.

This has big implications for students. It reaffirms our finding from *The Opportunity Myth* that remediation can become a vicious cycle: as gaps accumulate year after year, students miss more and more grade-appropriate content in favor of review of content from previous grades and become increasingly less likely to ever make it back to grade-level mastery.

Students of color and those from low-income backgrounds were more likely than their white, wealthier peers to experience remediation—even when they had already mastered grade-level content.

As Figures 2 and 3 show, Black and Latinx students, as well as students in high-poverty schools, were more likely to experience remediation than white students and those in lower-poverty schools who had identical success on early grade-level content.[6] Students in high-poverty schools were nearly twice as likely to be remediated as students in low-poverty schools, and in schools with mostly students of color, nearly 1 in 6 students were remediated—regardless of their success on grade-level content earlier in the year. In other words, faced with the similar data on grade-level mastery, teachers were less likely to believe students of color and those from low-income families were ready to engage with grade-level work.

FIGURE 2 | Students from historically marginalized communities were remediated more often than those who had similar success on grade-level content.

Percent of students remediated by the number of repeated struggle alerts per lesson in the first unit of grade-level content, for a class of 20 students
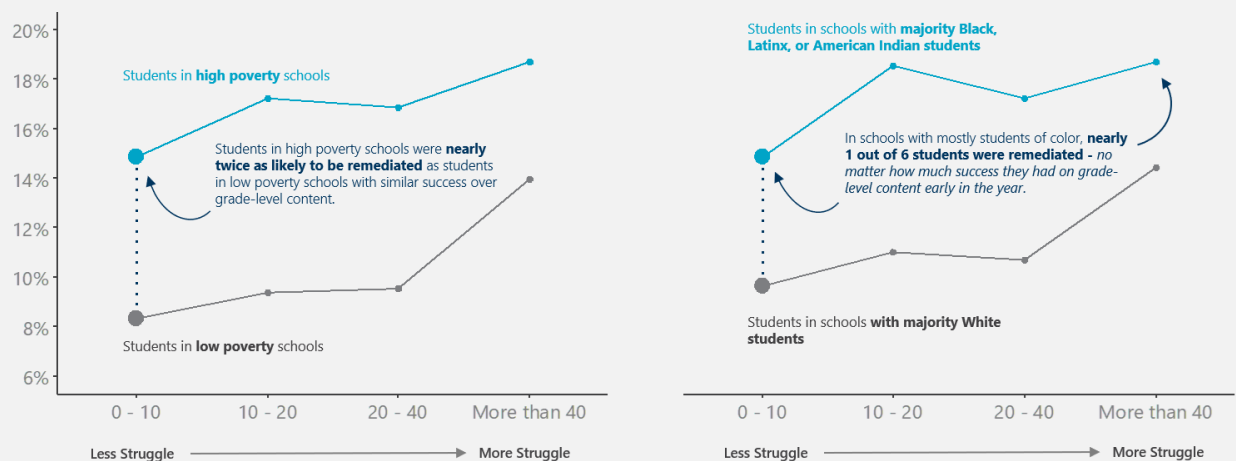
SOURCE: N = 2,249,669 students from 102,580 classrooms. Zearn data drawn from schools for whom Zearn has school-level demographic data in classrooms with sufficient student activity in 2020-2021 school year.

[6] Note: See Figures 2 and 3. In this analysis, only repeated struggle alerts from the first set unit of grade-level lessons in the Zearn platform are included. Remediation defined as spending at least 20% of time on Zearn lessons from the prior grade-level. High poverty schools defined as schools where at least 75% of students receive are eligible for free or reduced-price lunch (FRL); low poverty schools are schools where less than 40% of students receive are FRL-eligible. We also tested differences in the probability of remediation by school demographic classifications using a student-level logistic regression with controls for each school-level demographic group and their interaction with individual repeated struggle rate on the first unit of grade-level content. Estimates for students creating zero repeated struggle alerts were significantly different between students in majority white schools and students in majority Black, Latinx, or majority American Indian schools, and between students in low-poverty schools compared to students in high-poverty schools or mid-poverty schools.

FIGURE 3 | Students from historically marginalized communities were more likely to be remediated even when they are succeeding on grade-level content.

Percent of students in a classroom with only 0 – 2.5 repeated struggle alerts per lesson in the first unit of grade-level content, for a class of 20 students

Schools classified as ...	Percent Remediated	Schools with majority of...	Percent Remediated
Lower Poverty (0 – 40% students FRL-eligible)	8%	American Indian or Native Alaskan Students	46%
Mid Poverty (40% - 75% students FRL-eligible)	14%	Asian or Pacific Islander Students	8%
Higher Poverty (75% or more students FRL-eligible)	17%	Black Students	14%
		Latinx or Hispanic Students	19%
		White Students	10%

SOURCE: N = 2,249,669 students from 102,580 classrooms. Zearn data drawn from schools for whom Zearn has school-level demographic data in classrooms with sufficient student activity in 2020-2021 school year.
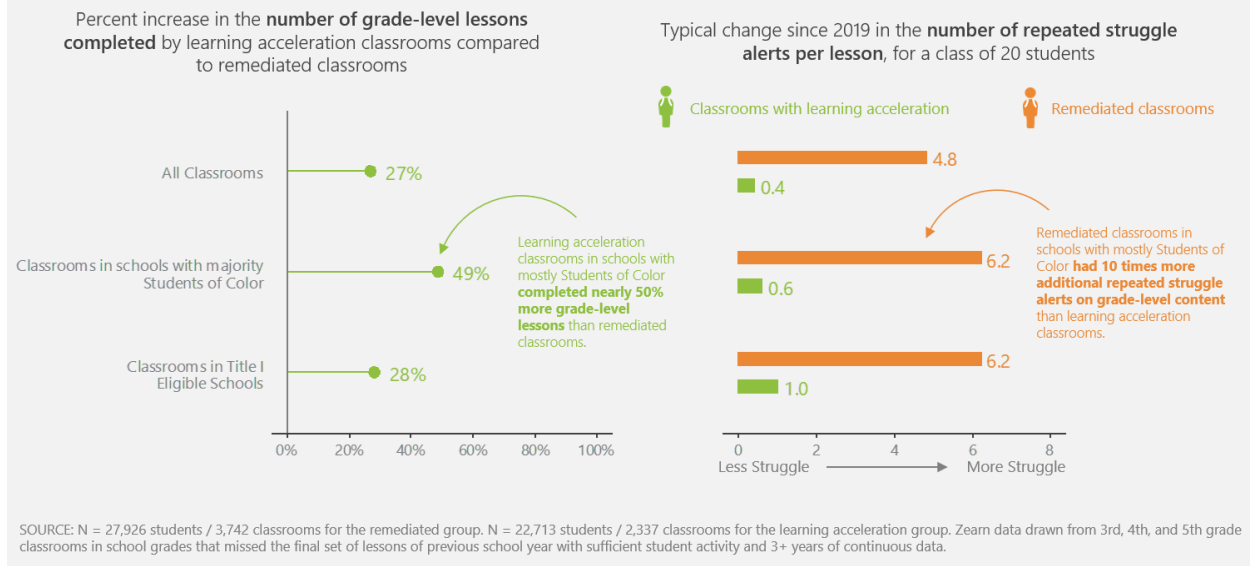
This isn't a new finding. Our past research showed that the choices of adults in school systems—however well intentioned—could have a pernicious effect on students from low-income backgrounds, students of color, multilingual students, and students with learning and thinking differences. For instance, in *The Opportunity Myth,* we saw that classrooms with mostly white students received 1.5 times more grade-appropriate assignments than classrooms with mostly students of color. This is an especially big danger as schools reopen their doors to more students with more unfinished learning than ever, since these kinds of choices could widen achievement gaps.

Learning acceleration was particularly effective for students of color and those from low-income families.

The good news is that when system leaders and educators adopt learning acceleration and actively choose to give all students access to grade-level material, it works—and our analysis suggests students of color and those from low-income families benefit the most.[7] While these students have historically been most likely to experience remediation, they also see especially large benefits from acceleration compared to remediation (see Figure 4). Classes that experienced learning acceleration in schools with mostly students of color saw a much smaller increase in their struggle rate compared to remediated classrooms (only one-tenth as large) and completed 49% more grade-level lessons. In Title I schools, classrooms with learning acceleration saw an increase in their struggle rate only one-sixth as large as in remediated classrooms and completed 28% more grade-level lessons.

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[7] See Figure 4. In this analysis, only repeated struggle alerts from grade-level lessons are included. Differences in the change in repeated struggle alerts generated by the two class types were tested with linear regression-based difference-in-difference models. The difference in 2019 to 2021 changes in total struggle alerts per lesson were significantly different from zero for both school types. Percent increase in grade-level lessons completed calculated by subtracting the mean number of grade-level lessons completed in remediated classrooms from the mean number of grade-level lessons completed in learning acceleration classrooms and then dividing that difference by the mean number of grade-level lessons completed in remediated classrooms.

FIGURE 4 | Learning acceleration was particularly effective for classrooms serving mostly students of color or students from low-income families.

Percent increase in the **number of grade-level lessons completed** by learning acceleration classrooms compared to remediated classrooms

All Classrooms — 27%

Classrooms in schools with majority Students of Color — 49%

Classrooms in Title I Eligible Schools — 28%

Learning acceleration classrooms in schools with mostly Students of Color **completed nearly 50% more grade-level lessons** than remediated classrooms.

0%   20%   40%   60%   80%   100%

Typical change since 2019 in the **number of repeated struggle alerts per lesson**, for a class of 20 students

Classrooms with learning acceleration   Remediated classrooms

4.8
0.4

6.2
0.6

6.2
1.0

Remediated classrooms in schools with mostly Students of Color **had 10 times more additional repeated struggle alerts on grade-level content** than learning acceleration classrooms.

0   2   4   6   8
Less Struggle ——→ More Struggle

SOURCE: N = 27,926 students / 3,742 classrooms for the remediated group. N = 22,713 students / 2,337 classrooms for the learning acceleration group. Zearn data drawn from 3rd, 4th, and 5th grade classrooms in school grades that missed the final set of lessons of previous school year with sufficient student activity and 3+ years of continuous data.

Recommendations

Our analysis provides strong evidence that learning acceleration—not the traditional approach to remediation—should be the foundation of school systems' plans to help students recover unfinished learning from the pandemic. While it may take several years to help every student catch back up to grade level, the choices system leaders make right now will determine whether it happens at all. With the help of funding from the American Rescue Plan, school systems have an opportunity to invest in the tools, training, and support necessary to successfully implement learning acceleration next school year and beyond.

It's important to note that while acceleration involves specific changes to instructional practice, it also requires a fundamental shift in mindset. The racial and income gaps in access to grade-level content we found in our analysis existed long before the pandemic: they are the norm, not the exception. Learning acceleration can only work when educators truly believe that all their students, with appropriate support, can succeed on grade-level content. As uncomfortable as it can be to discuss, these lower academic expectations for students of color—which are often reinforced by the training teachers receive throughout their careers—perpetuate systemic racism in our education system and keep too many students from reaching their potential. Providing opportunities for teachers to see their students succeeding on grade-level work is crucial to equitably implementing learning acceleration.

Invest in the Infrastructure for Learning Acceleration

Ensure students have access to high-quality instructional materials. Whether you are a school or district leader or a policymaker, you can help ensure your students have consistent access to grade-appropriate assignments by using high-quality instructional materials that are aligned to your state's learning standards. If you don't already have high-quality instructional materials (like those that meet expectations at EdReports), run an inclusive process to adopt them. Make sure that your process includes authentically engaging students, families, and your educators in your decision.

Once your students have access to high-quality instructional materials, ensure your educators have the support to use them well. This will mean grounding professional learning for teachers, principals, and central

academic staff in those materials. Educators need an effective introduction to the materials and to the expectations for using them. You'll want to anchor your professional learning around supporting teachers to prepare their units and lessons so they deeply understand the content within them and are able to deliver it well. In mathematics, this will often mean focusing on building educators' content knowledge and pedagogical content knowledge, so that they can make decisions about learning acceleration that are grounded in the coherence of math's big ideas.

Leverage your role in the educational system to elevate learning acceleration—rather than remediation—as a key to helping students recover from the pandemic and addressing longstanding inequities. If you are a leader at a state education agency, provide guidelines, supports, and resources grounded in learning acceleration. If you work at a curriculum company, ensure that you are providing guidance and support for educators that will help them accelerate learning using your materials. If you are a family member or caregiver, ask your school board members or the educators who work with your students how they are ensuring that all students have access to grade-level content in every class, every day. We all have a role to play in moving beyond the traditional approach to remediation that leaves far too many students behind.

Execute Equitably

Monitor whether your educators are making equitable choices for all students—especially students of color, students from low-income backgrounds, students with learning and thinking differences, and multilingual learners. Even when you have adopted high-quality instructional materials and provided support to help educators use them, it is imperative that you have systems to measure these choices and that you are prepared to intervene if you see these differences. Consider using the resources we've designed to support systems in asking students about their experiences and monitoring students' access to grade-appropriate assignments and strong instruction. It's critical to invest in gathering and analyzing this data: assume that inequities exist, and make sure you have systems in place to address them.

If your students need extra time, find it—and ground their additional supports in learning acceleration. In many cases, students missed significant instructional time because of COVID-19 school closures. Your system can find additional instructional time through structures like tutoring or resources like educational technology—but using that extra time well can be a challenge. As with regular classroom instruction, make sure to ground that time in grade-level standards rather than remedial coursework, making sure that the experiences students are having in the extra time are priming them for the grade-level work they'll be asked to complete in class. If you're going to leverage tutoring as an extra time strategy, consider the seven elements of high-impact tutoring.

Engage families, caregivers, and stakeholders in your learning acceleration strategy. Ensure that you are communicating often about the fact that your classroom, school, or system is providing students with access to grade-level content and the support they need to master it. In some cases, this strategy may be a significant departure from how you've done things previously—so it's important to be clear about that. Provide regular opportunities for your stakeholders to share feedback on your work and shape decisions around using American Rescue Plan funding to help students recover unfinished learning. This could mean engaging stakeholders in decisions about which high-quality instructional materials you'll select or how you'll create welcoming environments in your school buildings. Consider using our "Engaging Families and Communities in Reopening Efforts" resource to plan effective approaches to family, caregiver, and stakeholder engagement.

APPENDIX: Learning Acceleration Example

Imagine two third grade mathematics classrooms. Third grade is a seminal year in these students' mathematical careers. They are introduced to several big ideas of math: multiplication, division, and fractions as numbers, all of which are vital for their mathematics understanding in upper grades. In both classrooms, the teachers use a high-quality curriculum, teaching coherent, rigorous, and focused lessons that help students make sense of the math. Both teachers incorporate second grade lessons to support their third-grade students' unfinished learning, making choices based on what each believes is best for their students. Here, their philosophies and approaches differ materially.

The first classroom starts the year by fully covering the critical concepts from second grade before starting to teach third grade content; in the second classroom, key previous grade-level content was interwoven just-in-time as the class learns new third grade math ideas. By integrating unfinished learning into the context of new learning, students in the second classroom are able make connections and accelerate.

To see remediation and acceleration in action, let's consider the start of the third-grade learning, which is the first time children learn multiplication and division. Within the first weeks of school, imagine that students start to struggle—particularly when they first encounter partitive division, such as in the below word problem. How each teacher responds to struggle demonstrates this remediation and acceleration approach.
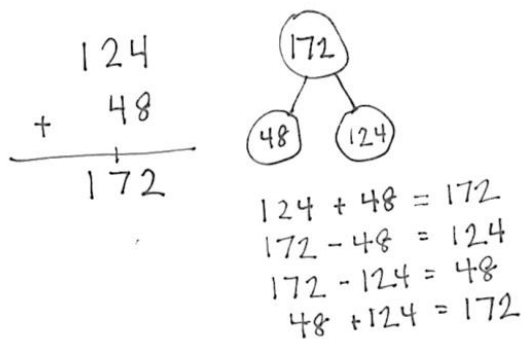
Third grade problem:
Ms. Alves puts 21 papers in 7 piles. How many papers are in each pile?

Classroom One: Remediation Approach

In the first classroom, the teacher uses results from a diagnostic test to inform which foundational skills she should address. Almost all her students are not yet proficient in second grade addition and subtraction standards. Knowing that this unfinished learning is critical to future learning, she makes choices based on what she thinks is best for her students. Her philosophy is to support her students to master the basics to allow them to succeed in grade-level math: going back to cover the critical content students might have missed from previous grades before jumping into the new grade's content. She pivots from the third-grade division problem and spends four to six weeks teaching second grade lessons to help students build fluency in two-digit addition and subtraction within 100. She then spends time working on second grade word problems to help students apply that fluency to a variety of problems, before moving to breaking numbers into parts and putting them back together—known as decomposing and composing—up to 200. While this work is critical to students' math understanding, it is isolated from the multiplication and division they need to learn at the start of third grade. By mastering the basics first, students do not make the connections they need to solve the partitive division problem.

Second grade lessons to help students build fluency in two-digit addition and subtraction within 100

Classroom Two: Learning Acceleration Approach

In the second classroom, one following an acceleration approach, the teacher has a different philosophy. To support students with division, she brings in a week or two of lessons from second grade that directly relate to the third-grade unit she is teaching. Specifically, she starts the year with a week of lessons from second grade where students explore equal groups and arrays. In these targeted second grade lessons, students use these visual representations to lay the conceptual foundation for multiplication and division and for the idea that numbers other than 1, 10, and 100 can serve as units. This second-grade work acts as a bridge between Grade 2 learning and students current Grade 3 learning.

Second-grade lessons to help students lay the conceptual foundation for multiplication and division
*Miss Tam arranges desks into 4 rows of 5. How many desks are in her classroom?*
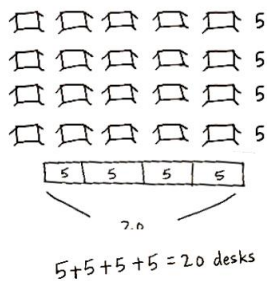
Specifically, these strategically chosen second-grade lessons act as an entry point to the third-grade partitive division problem of Ms. Alves' 21 papers. First, students represent their thinking with a picture that helps them understand the known parts of the problem: the total number of papers and the number of piles. This visualization helps students make sense of the math. They start by drawing individual items: the individual papers, just like they drew the individual desks. Students could solve the problem at this point, by simply counting the number of papers in each pile or the total number of desks. From here, these visualizations both offer the opportunity for students to also see that they can count by a unit other than 1: a group of 5 desks or a pile of unknown papers. Visually, students see items as groups, rather than individual items, an idea that will help them throughout the first big idea of 3rd grade. From here, they can relate the unknown factor to the size of each group, which in this problem is the size of each pile.

Integrating unfinished learning into the context of new learning
Ms. Alves puts 21 papers in 7 piles. How many papers are in each pile?
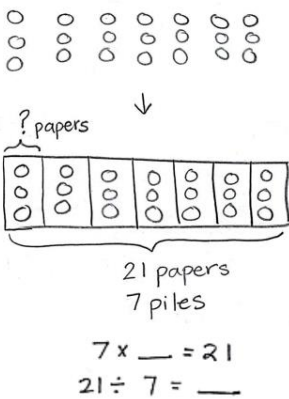
By integrating unfinished learning into the context of new learning, her students make connections and accelerate. Later in the year as students work through problems with all four operations, this teacher brings in another set of lessons from second grade that provide just in time support on our base ten system along with addition and subtraction within 200.

Both classrooms incorporated an equal balance of fluency, conceptual development, and application work, as they were using Zearn's high-quality materials; however, we know as a field that remediation often over emphasizes procedural fluency, when children need conceptual understanding to access grade-appropriate concepts. As such, effects of remediation in Zearn data may be understated compared to other curricula or remediation content.