Part One: Staying on Track
The Mathematics All K-5 Students Need Now Due to the COVID-19 Education Interruption
Naming the COVID-19 Education Interruption

We are all trying to do our part to keep one another safe and our future secure; we've made strides toward flattening the curve. The 'wins' have come as a trade. The decision to close schools in March for the remainder of the year was significant. Without strong leadership and thoughtful decision-making, it could have lasting implications for the educational sector at large, and for the 55,000,000 American K–12 children who have had 25% of their instructional year disrupted. My third-grade twin sons are two of these children. They are at home, working on learning the vital learning they need to stay on track with their educational progress.

The team at Zearn Math has always used our own children as the bar to create the highest quality math content. In this time of rapid transition, knowing that my children and other young learners have the support of our top-rated digital lessons, is comforting. We believe all kids can love learning math. We make this resource for our kids, your kids, and the kids you educate. The depth, accuracy, and thoughtfulness of the learning content and tools we create reflect our care for their wellbeing and our deeply held belief in furthering access to an excellent education for all.

Urgent Need

We don’t fully know the difficulties the COVID-19 pandemic will bring to the 2020–2021 school year or how decisions made now will reshape education. We do know that the work of supporting all learners in the midst of the pandemic falls on all our shoulders — those of teachers, administrators, policymakers, curriculum providers, parents and caregivers.

As educators and administrators work to adapt to the public health crisis, not only are they considering innovative educational options for the 2020–2021 academic year, they are also working to make up for shortfalls of our system, including efforts like supplying internet access for the 12,000,000 American students who live in homes without a broadband connection. Diving deeper into the societal challenges we face in educating all kids now, Zearn has analyzed data spanning nearly 60,000 schools, which shows a stark difference in learning patterns since COVID-19 between affluent and poor students. That aggregate and anonymized data has been synthesized by Opportunity Insights, offering valuable data points for policymakers to understand the needs of their communities.

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Our data shows that leadership matters. Strong leaders across the country are supporting teachers and families to help students continue engaging and progressing with mathematics learning. Of note, decreased participation in online math coursework may signal other community challenges.

Our data shows that course participation rates are lower among students from schools in low-income counties than among their higher-income counterparts. Above all, Zearn recognizes the importance for leaders to make evidence-based decisions on how best to support children’s continued education during the pandemic in order to mitigate the long-term risks of the “COVID slide,” as well as to proactively strategize for learning recovery in the 2020-2021 school year.

“To start the learning recovery, we want to offer the summer sequences that will position our kids to succeed in the 2020-2021 school year. “

Real Solutions

Despite the size and urgency of this situation, we intuitively understand the problem of learning loss and know it is far from beyond a solution. Describing it is step zero. Step one is to coalesce around a specific plan to address the learning loss and to do so equitably.

Our healthcare system offers a metaphor for how the educational system could do this today. As COVID-19 emerged, the leaders in our healthcare system identified what was going to happen, a healthcare system overwhelmed. They then rapidly developed and shared a specific plan to serve our country; they identified their specific needs to respond to the pandemic.

There is every reason to believe that the innovative, caring people collaborating to solve the educational crisis could achieve the same clarity, specificity, and plan of action. The effort is well underway. Zearn is a learning community of teachers, administrators, educators, software developers and designers passionate about creating a supportive and engaging math learning and teaching experience. Together, we are working to continually improve our materials and resources to ensure that all our kids can learn their grade-level math content. To start the learning recovery, we want to offer the summer sequences that will position our kids to succeed in the 2020-2021 school year.

Math Education for All Students

The Zearn Math hands-on and digital curricular resource is used in 60% of elementary schools, making us a unique source of information and learnings. With machine learning algorithms synthesizing patterns across more than five billion problems completed on our platform and in partnership with the wisdom of educators, we have identified the vital content that our rising 1st through 6th graders may have missed in the last 25% of the school year. This paper provides insights and an outline of the threshold math that all students should be doing right now to address learning loss.
Solving the K-5 Math Missed Learnings

Rising 1st through 6th graders have specific and necessary math learning requirements. There is simply no substitute for school-based learning with a teacher and peers to gain this knowledge and develop positive math mindsets regarding productive struggle. With the school closures this academic year, that option is unavailable to our young learners. However, it is possible to work on specific mathematical topics as part of students’ extended summer learning.

As we support all of our children with a learning recovery in mathematics, we must use the structure of math itself to guide us. Math consists of a few big ideas. It is not a laundry list of skills or procedures or a set of secrets known only to mathematicians. In reality, it is just a few beautiful axioms. Once learned, these axioms describe the universe. We know that a firm grounding in the few big ideas of math presented in elementary school matter most to laying a firm foundation for success in upper grades.
Kindergarten is about learning to count with deep understanding. Students should be exploring numbers every day. Rather than mindlessly memorizing the numbers to 100 (similar to memorizing the ABC song), these youngest students need to understand what numbers are. Doing so will set up strong understanding and fluency with addition, subtraction, and later mathematics. By the end of kindergarten, children should be counting masters.

Kindergarteners should be able to count in both directions, starting at any number within 100. They need to understand that numbers are flexible: 2+3 = 5, and so does 4+1. And so does 1+1+1+2.

During school closures, students may have missed working deeply and concretely to put together and take apart teen numbers. This work typically corresponds to at least 20–30 days of instruction. Missing this learning time could result in a slower path to a deep understanding of and fluency with addition and subtraction.
1st Grade: Place Value Foundations

1st graders work on big ideas of mathematics like understanding place value. Students also explore measurement and shapes. They learn many strategies for addition and subtraction first within 20, then within 40, and finally within 100. Ideally, this addition and subtraction work is grounded in concrete manipulatives, place value strategies, and story problems to help students visualize and deeply understand the math.

From March to June, students would be continuing to learn to add and subtract with numbers within 40 to 100. That means they would be working with problems such as $21 + 13$ or $18 + 16$ and progressing to a problem like $48 + 33$.

During school closures, students may have missed exploring more sophisticated story problems and extending addition and subtraction place value and flexible mental math strategies to 100. This work typically corresponds to 20–30 days of instruction. The implication of this gap is a slower path to being addition and subtraction masters.
2nd Grade: Addition and Subtraction Masters

In 2nd grade, students must become addition and subtraction masters. In doing so, they come closer to mastering the system of Base 10. Multi-digit addition and subtraction grounded in place value is essential content that is not taught in 3rd grade in most curricula because it is assumed knowledge! Third grade standards and curricula assume children have deep place value understanding and make a shift to developing fluency in the standard algorithms.

The end of 2nd grade is critical. Students would be focusing on mastering flexible addition and subtraction up to 1,000, and applying addition and subtraction strategies to real life contexts. They also learn that numbers other than 1, 10, and 100 can serve as units and learn to count by equal groups other than 1, 10, and 100. This prepares students for 3rd grade multiplication, fractions, and even algebra.

During school closures, students may have missed multi-digit subtraction and addition with regrouping. Students may be learning this idea with a place value chart, a traditional stacked algorithm, or both. This work typically corresponds to 20–30 days of math instruction. The implication of this gap is a risk that students are expected to demonstrate fluency with addition and subtraction in 3rd grade and they would lack foundational place value understanding.
3rd Grade: Multiplication and Division Masters

3rd grade is a seminal and fun math year. Children get to master multiplication and division of whole numbers within 100. They also get their first exposure to fractions as numbers, which is vital for their mathematics understanding in upper grades.

Mastery of Algebra I and one other high school math course is the highest correlating factor to getting into and through college. A strong understanding of fractions in third and fourth grade highly correlates to a mastery of Algebra I in later grades. If students miss this foundational work in third grade, it can make it challenging to succeed in later grades.

For many children across the country, the timeframe between March and June would have been a vital time in their mathematical lives. During school closures, students may have missed the chance to study the concept of fractions as numbers we can work with mathematically. This work typically corresponds to 30 days of instruction.

While 4th grade fractions work has some revisiting embedded, it is not enough that we should feel comfortable with four million 3rd graders having missed about 30 days of instruction in fractions as numbers. The implication of this missed learning could be a slower and more difficult journey to mastery of Algebra I.

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Fourth grade is a big year in mathematics. Students learn multi-digit multiplication and division. They explore geometry. They work deeply with fractions and begin to work with decimals. March through June typically would be when children are working with fractions and decimals.

They would be adding and multiplying fractions and would learn about decimals as an extension of fractions for the first time in their mathematical careers!

In our ‘secret’ pilots of Zearn Math for middle school, we have found decimal operations to be an essential area of content that, if missing, can derail our middle schoolers as they grapple with more advanced concepts.

This vital fractions and decimals work typically covers 40 days of instruction. The implication of missing 4th grade fractions and decimals work is heading into 5th grade without understanding the equivalence between fractions and decimals. When we work with fractions and decimals as adults, most of us jump back and forth between them. The instruction in 4th grade is the foundation of this ability.
5th Grade: Operations Masters with Whole Numbers and Fractions

By the end of 5th grade, a student would be proficient with nearly all operations with whole numbers, fractions, and decimals. In addition, 5th graders are introduced to the coordinate plane and volume during this time of the year.

In 5th grade, students would be grappling with a problem like 519 \times 326 and be able to solve it in multiple ways and in a word problem context. They would also be able to smoothly connect this question to 5.19 \times 326 and solve that problem as well.

These vital fractions and decimals operations work, plus the introduction to the coordinate plane and volume covers 45 days of instruction. The implication of this gap is missing the culmination of 3rd, 4th, and 5th grade learning as well as crucial foundations of 6th grade. Without this time to synthesize and build deep understanding, 6th grade math could feel more like rote memorization than deep understanding.

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Mrs. Silverstein bought 3 mini cakes for a birthday party. She cuts each cake into quarters and plans to serve each guest 1 quarter of a cake. How many guests can she serve with all her cakes?

\[3 \div \frac{1}{4} = 12\]

There are 4 fourths in 1 whole. There are 12 fourths in 3 wholes.

Mrs. Silverstein can serve 12 guests with her cakes.
The Educational Path Forward

There may never have been a better time to put a significant focus on working to support all students to love learning math. There are three critical steps to addressing and recovering the learning losses that may have been caused by the COVID-19 educational pause. If we do these three steps well, we also have the potential to address unfinished learnings that arise naturally as students learn new content, so students can move smoothly to and make connections with mathematics in later grades.

**Step One: Identify the Content**

*Name the specific critical content by subject and grade that each child must master now to support a successful 2020-2021 academic year.*

Leveraging teacher guidance and feedback alongside our extensive dataset of over five billion completed problems, we have identified the critical content for our rising 1st through 6th graders. In Part Two of this series, we will offer more detail, with revised scope and sequences by grade so that educators can support students as they transition back into the classroom. We hope others offer their specific recommendations by grade and subject to support our 55,000,000 children.

**Step Two: Determine the Resources**

*Select resources, ideally digital and paper-based until all children have digital access, to match the content guidance for all kids.*

There is no substitute for time in the classroom, discussing ideas and building a community of learners with teachers and peers. Digital resources that engage students and provide personalized feedback are critical tools in the absence of these necessary learning conditions. Further, when we use digital solutions to bolster learning, we always must consider the 12,000,000 students who lack broadband access.

"More than 20% of our students don’t have the devices or broadband to participate in the digital world of learning right now."

**Step Three: Build the Programs**

*Build programs structured and organized at the state-, district-, or school-level to recover the COVID learning loss, not merely to assess students for gaps.*

To compare education to the healthcare system, testing students for gaps without...
an instructional plan to recover would be like hospitals testing for COVID-19 with no plan for treatment. These recovery programs should have requirements to support equity while having degrees of freedom to allow for schools and districts to implement based on the needs of their specific communities. We will use these plans again, should we experience rolling closures next year. These plans should require schools and districts to monitor who is learning during school closures and go more in-depth to monitor and ensure that all kids are mastering the critical areas mandated.

Progress is Possible

Schools and districts are stepping up. We see educators, corporations, and public entities distributing devices and sending hotspots out into neighborhoods using their buses. We may capture opportunity in this crisis — if we work together to keep our kids on track after disrupting 25% of their classroom time.

Zearn is contributing to the urgent work of COVID-19 learning loss recovery for all rising 1st through 6th grade students. For example, parents and teachers can go to Zearn Math for free summer sequences that cover the foundational K–5 math content our kids need to succeed in the 2020–2021 school year.

Zearn Math is providing many of the learning resources our students need to catch up, keep up, and excel. We hope that the information, as well as the approach, will be useful to policymakers, administrators, teachers, parents, and caregivers. We also hope it will inspire others working in core subjects and grades to share their own well-tested recommendations so that, together, we can use this time to move our educational system forward.

We are carefully assessing what education may look like for 2020–2021. In Part Two of our learning recovery offering, we will share revised scope and sequences by grade grounded in our data so that educators can support our young learners as they transition back into the classroom and set them up for a successful 2020–2021 academic year where all kids can love learning math.

About Zearn Math

Zearn is a nonprofit curriculum publisher on a mission to ensure all children love learning math. Zearn publishes Zearn Math, a top-rated K–5 paper- and software-based curriculum that creates engagement and differentiation for all students. Zearn Math includes 400 hours of digital lessons with on-screen teachers and supportive remediation, and is available at no cost to individual teachers and families. In addition to curricular materials, Zearn Math offers comprehensive professional development and School Accounts to support district- and school-wide learning. Visit about.zearn.org or email support@zearn to learn more.

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