

The background of the left half of the page is a close-up photograph of aloe vera leaves. The leaves are green with prominent white serrated edges and are arranged in a dense, overlapping pattern.

How to Address Pandemic Learning Loss and Close Learning Gaps: Math Intervention Resources and Tutoring Practices for Elementary Schools

Several reports confirm that during the pandemic school closings, math achievement and growth [declined the most](#). K-12 officials know that steps must be taken to address this “pandemic learning slide,” and [a February 2021 EdWeek Market Brief](#) article reported on the programs and strategies that schools and districts plan to use over the next year. Almost half (43%) of K-12 officials surveyed intend to provide tutoring via paraprofessionals, teachers’ aides, and volunteers. Those three groups will be a much-needed support for teachers as students return to school, but they themselves are going to need support in terms of resources and guidance on best practices.

A good starting place to assay best practices is the research of Professor John Hattie, the author of *Visible Learning* and *Visible Learning for Teachers*. Professor Hattie is famous for amassing an enormous collection of evidence-based research on what improves students’ learning. In fact, his website contains a [graph that compares the efficacy](#) of different factors and instructional practices in terms of student learning. But as previously stated, that’s just a starting point.

Educators are viewing this summer as an opportunity to get a head start on addressing learning loss — or closing academic gaps from previous grade levels — before the new academic year. It’s imperative to make the most of that time for the school year to run smoothly.

This guide will share ideas, practices, and tools that can support the efforts of volunteers, aides, and paraprofessionals providing math tutoring in elementary schools.

Make Math Fun and Meaningful

After more than a year of distance learning and mostly unstructured time, many pupils will have difficulties readjusting to in-person instruction and classroom routines. Those difficulties will make it harder for them to focus on learning.

Keeping pupils motivated will make their readjustment easier and keep them on task. And making math instruction fun and relevant (rather than relying on rote learning) will foster motivation and engagement. As an added benefit, when students have fun while learning, they find the process more memorable. Thus, they retain information better.

One way to motivate learning is through an intriguing introduction, such as a storyline narrative or an engaging activity, for each concept or skill. For example, a tutor could prepare pupils for lessons involving comparing numbers with a video clip showing children playing a video game. Pupils can relate to the everyday event and so will find more meaning in discussing guided questions on how to determine the higher score.

Guided question examples include the following:

- Which number is bigger: 14 or 41?
- Which of those numbers has more tens?
- Since 14 has more ones, why isn't it greater than 41?
- Which place value should we look at first when we're trying to decide which number is greater?

• Connect Math to Real-World Activities and Jobs

As stated above, using real-world examples is an effective way to capture pupils' interest. Children will often see math as unpleasant and baffling if they can't understand how it relates to the real world. That's a normal human reaction: If you perceive something as meaningless, it becomes harder to remember and understand.

Showing how math has connections to their lives or potential careers will make the subject meaningful to students. Pupils in kindergarten through second grade will respond to connections to things they frequently observe or experience, such as games, eating, etc. Children in later grades (third grade through fifth grade) pay more attention to possible careers. Therefore, they will be interested in how math relates to different jobs they might choose in adulthood.

So, tutors can have pupils in grades 3 and up read a brief biography of a famous person in a career (e.g., a climatologist) that has math embedded in it. Then the tutors can have pupils investigate exactly how math is correlated to that job.

• Use Hands-On Exploration

Hands-on math activities are also very handy for engaging elementary school learners. For such activities, use physical or virtual manipulatives — tools that students can move around to explore mathematical concepts. Tutors will start a lesson with manipulatives by modeling the use of the physical or virtual manipulatives for the whole class. Scaffolding will enable students to reduce their dependence on manipulatives over time.

In fact, the CRA (Concrete, Representational, Abstract) instructional approach is specifically designed to help students transition from using manipulatives to using abstract reasoning. CRA is an instructional sequence where each lesson relates to previous ones. Pupils pass through three phases:

- **Concrete:** In this initial stage, the tutor models how to arrive at a solution by using physical manipulatives (e.g., chips, blocks, pattern blocks, fraction bars, or geometric figures). Students then use the objects to explore the new math concept or skill.
- **Representational:** Once pupils master using manipulatives to solve problems, they move on to pictorial representations that mirror their work with the concrete objects. They may draw pictures or work with images.
- **Abstract:** Once students are comfortable working with pictures and images, tutors can model the mathematics concept using abstract representations such as numbers, notation, and mathematical symbols.

Note: A digital curriculum platform can help tutors interweave CRA activities into lessons. Platforms that also include print resources as well as kits will enable tutors to easily manage CRA integration.

• Include Debate and Discourse

The National Council of Teachers of Mathematics (NCTM) [recommends facilitating meaningful discourse](#) in which learners share their mathematical reasoning. Several [studies](#) also support the notion that having learners discuss their ideas is the key to “instilling the concepts, skills, and thought processes that are necessary for students' long-term mathematical success.”

Discussing mathematical concepts with each other allows pupils to figure out if they have any misconceptions. It also gives them the chance to explore different ways to solve a problem and realize that math is not about being rigid. Also, participating in math conversations causes pupils to reflect on what they've learned and consequently, retain more of that new knowledge.

Tutors can use guided questioning and encourage peer-to-peer discourse to facilitate class discussions. For instance, they can have pupils conduct a “[turn and talk](#).” This activity involves the following steps:

1. Divide a class into pairs.
2. Pose a question or prompt for discussion, and tell pupils how much time they will have (one or two minutes is best).
3. Set a timer and have discussions begin.

4. When the time is up, ask the pairs to share thoughts and ideas from their discussion.

This activity gives all members of a class a chance to be part of the discourse rather than having only a few individuals speak up during a class-wide discussion.

• Embrace Problem Solving and Productive Struggle

Productive struggle is effortful learning that the [Mind Research Institute](#) describes as developing “grit and creative problem solving.” Productive struggle requires pupils to work through increasingly challenging and unfamiliar problems. This approach causes them to make connections between different math concepts so they can look at the “big picture” of solving problems instead of just memorizing a formula.

Tutors can provide independent or collaborative tasks that allow pupils to solve challenging, meaningful problems in a real-world context. Pupils should be given the flexibility to use different processes and strategies to reach a solution. That way, they will develop fluency and confidence as they become more efficient and accurate in solving problems.

Identifying Pupils That Need Help and Pinpointing Areas of Struggle

In addition to the engagement strategies mentioned above, tutors will need to figure out which pupils have fallen behind their peers and what caused each one’s decline in learning.

• Diagnostic Testing

Using diagnostic testing to establish Beginning of Year (BOY), Middle of Year (MOY), and End of Year (EOY) benchmarks helps determine how much students have grown from the instruction they received over an academic year. An added benefit is that tutors can use data from diagnostic testing to target areas of need such as knowledge gaps as well as misunderstandings that occurred in previous grades.

Digital curriculum solutions with diagnostic testing resources provide educators and tutors with actionable data for focusing instruction. E.g., STEMscopes Math includes BOY, MOY, and EOY benchmark assessments and integrated Quantile measures that track student progress and help educators address areas of struggle with pinpoint accuracy.

• Determining Why Progress Was Blocked

Students’ COVID-19 experiences may have impacted their math learning in any number of ways. Understanding what caused the issue can provide a better understanding of what made them unable to perform as they normally would. And that understanding can help guide remediation. So, educators and tutors should ask themselves the following questions about pupils’ lockdown experiences:

- Did pupils have equitable access to learning materials?
- Did they have parents at home to support them in virtual learning?
- What impacts of social-emotional learning (SEL) were or were not taken into account?
- How could the presence or absence of SEL have influenced pupils’ emotional wellbeing and motivation to learn?
- Using Open-ended Questioning to Detect Areas for Growth

Closed-ended questions (e.g., “4 or 5: Which number is bigger?”) focus on a right answer. Open-ended questions (e.g., “What skills have we learned in class that you could apply to this problem?”) give insights into misconceptions and provide a good overview of what students know.

In fact, open-ended questioning serves several purposes:

- It helps teachers and tutors assess students formatively throughout a lesson and over the course of many lessons.
- It enables teachers and tutors to monitor individual and class-wide progress, and adjust subsequent lessons accordingly.
- It enables teachers and tutors to differentiate instruction by student ability and learning style, asking questions that meet students where they are and encourage them to move forward.
- It teaches students metacognition — the ability to observe their own thinking and learning process. That ability will give pupils a better sense of their own strengths and weaknesses, competencies and areas of growth, so they can maintain insights about their own abilities within a wide range of domains.

Note: Using open-ended questioning in instruction requires a specific set of skills and strategies. The [STEMscopes Mathematical Questioning Guide](#) shares those skills and strategies as well as potential pitfalls to avoid.

• Getting to Know Each Pupil Personally

Knowing every pupil personally means understanding what motivates a specific child and drives their interest. One pupil may pay more attention to instruction that incorporates social issues (e.g., pollution). Another may perk up at references to a popular fictional character or television series.

Two ways to figure out what sparks pupils' interest are using an interest survey and having one-on-one chats with students. Instructors can use free online tools like [Poll Everywhere](#) and [Survey Monkey](#) to quickly create interest surveys. The surveys can contain not only questions but also statements accompanied with a [Likert scale](#) (providing options for "Strongly Disagree" all the way to "Strongly Agree"). Since pupils may be more honest if they can take the survey anonymously, it's advisable to make including names optional.

• Using Frequent Checks for Understanding

Checks for understanding (CFUs) or comprehension checks like thumbs up/down are quick, visual formative assessments that gauge student understanding throughout a lesson. The practice allows on-the-spot reteaching or adjustments in instruction. It also ensures no student simply stays silent and ignored. CFUs are easy to implement, and instructors can find [15 examples](#) at the website WeAreTeachers.com.

Helping Non-Experts Deliver Effective Math Interventions and Instruction

An instructional intervention is a program or set of steps designed to boost learners' performance in areas that they have found challenging. Interventions can be delivered one-on-one or in small groups. What an intervention class might look like will vary according to the state and district. The [Institute of Education Sciences](#) emphasizes that intervention groups should be as homogeneous as possible in terms of their learning needs.

• Ratios of Pupils to Tutor

Institutions differ in their recommendations of how many pupils that one adult should work with in an intervention group. According to the IRIS Center, which is supported by the U.S. Department of Education's Office of Special Education Programs, Tier 2 groups in a Response to Intervention (RTI) model should have [three to five pupils](#). It also states that Tier 3 groups should have no more than a [1:3 teacher-to-pupil ratio](#).

On the other hand, [the RTI Action Network](#), created by the National Center for Learning Disabilities, recommends that Tier 2 groups in a multi-tier support system (MTSS) should be between five and eight students. However, it agrees with the IRIS Center about the size of Tier 3 groups being three at the very most.

Note: The National Association of School Psychologists has recommended not waiting to sort students into Tier 2 and Tier 3 groups once they return to the classroom. Instead, the association has outlined guidelines for [class-wide math intervention](#).

• Incorporating SEL and Community Activities

Curriculum and instruction that give pupils the chance to develop core social and emotional competencies have been shown to produce [increased academic achievement](#) as well as improved attitudes and behaviors. In addition, discipline problems and emotional distress decrease among students that take part in SEL.

The five areas of social and emotional competence as defined by the Collaborative for Academic, Social, and Emotional Learning (CASEL) are: self-awareness, self-management, social awareness, relationship skills, and responsible decision-making. Below are suggestions for incorporating these competencies into math instruction.

- **Self-Awareness:** As stated earlier, math instruction should provide an opportunity for pupils to debate, present their reasoning, and share their thinking. Tutors should have learners work alone, in pairs, or in teams to explain why they reached the conclusions they did. Pupils will have to demonstrate self-awareness by monitoring what they say and how they say it during this activity.
- **Self-Management:** Students should have the opportunity to analyze their thinking through three unique lenses: content, process, and affective (emotional). By sharing their thinking in a small group or with a partner after working independently, students can practice self-management as they experience different points of view. For example, pupils will need to manage their stress when developing and presenting ideas to their peers. Additionally, pupils will have to control their impulse to interrupt classmates with whom they disagree.

Tutors can also present questions and have pupils reflect on their emotions during an activity. For example, they could examine how doing the work made them feel and how they felt if their partner solved the problem in a different way but got the same answer.

- **Social Awareness:** When math instruction is relevant to students' lives, it's easier to incorporate current issues (e.g., how the use of fractions could impact recycling). Create or look for lessons that come with media and questions that spark dialog on social topics so that pupils become more socially aware while developing math skills.

A more interpersonal type of social awareness can be developed by pairing pupils with behavioral challenges with mature peers. The behavior-challenged pupils are encouraged to observe and imitate the more mature classmate's behavior. Through that imitation, the struggling pupils will have an opportunity to experience the world from their classmate's perspective.

Additionally, students can be instructed to face each other and maintain eye contact during one-on-one dialogues. This practice encourages them to observe and react to emotional markers and indicators.

- **Relationship Skills:** Activities such as think-pair-share and turn-and-talk enable students to hone relationship skills and be openly vulnerable as they tackle new and challenging content together. Tutors should encourage learners to listen and respect their peers as they ask questions and wonder aloud. In addition, they should help learners to feel comfortable asking for and offering help.

Pupils can participate in role-playing activities that allow them to practice the use of appropriate manners and body language. They should also be coached on how to communicate questions clearly and succinctly. In addition, pupils can practice resisting social pressure that creates a hostile environment where they fear asking "stupid questions."

- **Responsible Decision-Making:** From setting goals to figuring out how to communicate about math, students have multiple opportunities to learn responsible decision-making while strengthening classroom norms. Tutors can foster this competency as they establish classroom rules that foster safety and social norms, for example, respecting others' personal space and saying "excuse me" and "thank you." Students uphold high ethical standards as they demonstrate respect for peers through behaviors such as active listening and teamwork.

Additionally, tutors can help students manage math anxiety by providing them with steps or metacognitive questions to use whenever they face a challenge. For example, if pupils are struggling with computation or understanding a word problem, they can use the problem-solving model below.



Skill Basics

Addition and Subtraction Problem Solving

Story Problem Cards

Problem 1

Sarah had some fruit snacks. She gave 14 to her little brother. Now she only has 25 left. How many fruit snacks did Sarah have to begin with?

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1



Skill Basics

Addition and Subtraction Problem Solving

Problem-Solving Model Explanation Sheet

Important Information	Plan or Strategy
<ul style="list-style-type: none"> • What is the story about? • Who or what is the main character? • What action is happening in the story? • What is the problem in the story? • Are there any words I do not understand? 	<ul style="list-style-type: none"> • What strategy might I use? • Is there another way I could solve? • Do I need manipulatives, technology, pictures, words, or symbols? • Is this like any problem I have worked before? • Which way would be most efficient to solve?
Solution	Justify Your Answer
<ul style="list-style-type: none"> • Does my strategy work? • Have I checked each step of my strategy? 	<ul style="list-style-type: none"> • Is my answer reasonable? • Does my solution answer the question that was asked? • Is there more than one solution to the problem? • How can I prove that my solution is correct? • Is there a different way I could solve to check my answer?

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1

Take this second-grade math problem as an example:

Kimberly wants three cookies. On each cookie, she would like 10 chocolate chips. How many chocolate chips would you need to fill this order?

Pupils can use the following steps to solve the problem:

- Represent the situation using manipulatives.
- Figure out how repeated addition can be used to find the answer.

• Additional Problem-Solving Model Example

Below is a second-grade addition and subtraction problem-solving model which can also be used in the third, fourth, and fifth grades. In this problem-solving model, pupils must write down the important information, devise a plan or strategy, find a solution, and then justify their answer (see the diagrams of the exercise and the explanation sheet below).

Here's how the problem-solving model works:

1. Divide the class into pairs.
2. Distribute a student handout and dry-erase marker to each student. Give each pair of students one Problem-Solving Model Explanation Sheet.
3. Tell students they will practice solving addition and subtraction story problems using a problem-solving model.
4. Direct students' attention to the Problem-Solving Model Explanation Sheet.
5. Explain each section of the model.
6. Project the problem. As a whole group, practice solving the problem using the problem-solving model. Model for students how to solve as they follow along and solve on their student handouts.
7. Read the story problem.
8. Say, "Look at your first box on the student handout. This first box is where we will write important information from the problem."
9. Ask the following questions:
 - a. What information do we know from the problem?
Sarah gave 14 fruit snacks to her brother. She has 25 left.
 - b. What information are we trying to find out? Her starting total of fruit snacks.
10. Model how to fill in the first box of the problem-solving model. Numbers, names, and important words will be written here.
11. Say, "Now we need to complete the second box in our problem-solving model. This is where we decide what strategy to use to solve the problem. What are some strategies we could use to solve this problem?"
12. Allow students time to discuss with their partners. Possible strategies include using a strip diagram, picture, number line, ten frame, etc.
13. Model how to fill in the second box of the problem-solving model using one of the strategies suggested by students.
14. Say, "Now we need to complete the third box in our problem-solving model. This is where we show our solution or write our answer."
15. Model how to write the answer to the problem in this box.
16. Say, "Our last step is to complete the fourth box in our problem-solving model. This is where we justify our answer. How can we prove we are correct?"
17. Allow students time to discuss with their partners. Possible strategies include writing a number sentence to check their work, drawing a picture, explaining how they solved in words, etc.
18. Repeat the preceding steps using other story problems. Do up to four problems and challenge students to complete the fourth problem without your help. Check the work as a whole group.
19. Monitor and facilitate discussions as the students work to complete the problem-solving model by asking the following questions:
 - a. Why do you think this strategy is important? (Answers will vary. E.g., It helps us break the problem apart and work through it step by step.)
 - b. Can you explain to me what you did during this strategy?
 - c. What was your favorite part of the problem-solving model?
20. As students work through similar problems in the future, give them access to the Problem-Solving Model Explanation Sheet to use as a reference when solving story problems.

• Independent vs. Group Work

When to schedule independent work versus group work is ultimately a matter of instructor preference. Some tutors will prefer to introduce a concept or skill to the entire class and then have students hone their understanding by working in groups or pairs. Finally, they will ensure students have achieved mastery by assigning them solo work.

Other instructors will prefer to introduce a challenging task by having pupils work on it independently. Then they'll move on to collaborative work and finally, use a whole-group activity.

In each case, it's important to bear in mind that the aim is to develop students' ability to use mathematical reasoning independently.

• Time Blocks for Interventions

Many schools schedule time during a school day or week for students to receive extra help. Pupils are strategically grouped to receive targeted skills support.

Schools may already be using diagnostic data from digital curriculum platforms, software, and other formative assessment sources to identify students in need of intervention. If there's still a lack of progress during those blocks, tutors will need to consult the data once more to determine if a student needs a greater level of support or simply needs more time in terms of session length or frequency.

• Additional Ways of Providing Academic Support

One way to support students' academic progress is by supporting the people who will be tutoring them. One of the difficulties likely to arise is that many of them, especially volunteers from the community, may not be familiar with pedagogical strategies (e.g., CRA) currently being used. So, they will need content support (background information on how and what the student is supposed to learn).

Otherwise, those volunteers, if left to their own devices, will deliver instruction in the ways they received it as children. In many cases, that means jumping straight to the algorithm, which is not what the standards require. But volunteers cannot be expected to understand (or even be aware of) what the state standards want pupils to be able to do.

One solution is to provide introductory letters (like the letters sent to parents to help students learn at home). These can explain each unit and include the models, vocabulary, and menus of activities and tasks. The teacher-facing materials in digital curriculum platforms are also likely to contain an introduction that explains what to do and what to expect as students work through lessons.

Supporting pupils academically also means equipping them with the knowledge and skills that will enable them to succeed with multiple testing modalities. In addition to high-stakes testing, pupils should be able to handle the following:

- Argumentation-based assessments that they must reason through and defend
- Multiple choice
- Fill in the blank (computation)
- Drawing representations
- Explaining concepts to a peer

The objective should be to make learners well rounded enough for all those evaluations. Students need to understand math for multiple dimensions. Otherwise, they'll just think about getting the right number without really knowing why.

• Supporting Pupils Socio-Emotionally

Some of the people who will be providing tutoring may not have seen children for a year or so. But suddenly, children will be physically present with them in June or July. Those individuals need to be prepared for several issues:

- Pupils who have no behavioral norms because their parents have been too busy or distracted to give them attention.
- Pupils who have not read anything beyond sentence fragments online, so their skills for deeper understanding will need to be reactivated.
- Pupils who have breakdowns in the classroom because they no longer know how to interact with peers after a year of being isolated from friends.

Below are some activities that can be incorporated into class time to help pupils de-stress and readjust to the classroom.

- **Daily Emotional Check-Ins:** Check-ins can be done at the start of class or for individual students. Pupils will identify their current feelings and figure out aloud how to regulate their emotions if it's needed. Procedures will have to be put in place for students who indicate that they are depressed. Also, tutors will need some training on how to identify and support students who may seek attention by exaggerating negative emotions.
- **Mindfulness Practices:** Mindfulness is a useful skill that can help learners calm down before a test or when they are upset. [Mindfulness practices](#) include deep breathing (taking slow, deep breaths) or observing the emotions they're currently feeling.
- **Releasing Body Tension:** Tension within the body often produces or intensifies negative emotions. Tutors can use directed movement exercises (such as jumping jacks) to change students' physical state, thus changing their emotional state.

Recovering from the Pandemic's Damage is a Process

Everyone has been looking forward to getting “back to normal.” But returning to normalcy will be a process. As pupils return to physical classrooms, we need to assess and remediate the damage that’s been done.

COVID-19 dealt a blow to some children’s educational progress, especially those who were not able to transition to online learning and/or suffered economic insecurity. Likewise, the uncertainty and social isolation that these pupils endured will have hindered or even damaged their emotional health and social development.

But just as educators, parents, and communities rallied to make it through the pandemic, they can heal its blows. This guide is designed to be a resource as educators and volunteers begin that work. Together, we can ensure they have the greatest comeback possible.

About Accelerate Learning

Accelerate Learning has over 200 practicing teachers who help write curriculum, field test lessons and assessment items, and review and edit all materials to ensure factual accuracy, so our curriculum is current and practical for implementation in any type of classroom.

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