My Math Academy

2022

# Implementing Personalized Technology to Drive Equitable Learning

Pre-K Through 2nd Grade

Age of Learning
creators of ABCmouse

# Executive Summary

The last two school years have forced educators and families to reimagine fundamental ideas of what equitable learning looks like. Districts' shift to virtual learning further revealed inequities beyond the classroom and emphasized the role of other social contexts where learning and child development take place. As students return to classrooms, addressing unfinished learning stemming from pandemic-related disruptions requires a holistic approach that uses personalization to serve all the individuals who are part of the learning ecosystem of the student: the student, their parents and caregivers, teachers, and administrators.

While many digital tools and solutions attempt to use personalization and adaptive technology to address each student's unique needs, we believe it is important that solutions support personalization across the entire learning ecosystem to support whole child development in a meaningful way. In order to clearly define the objectives of such a solution, an interdisciplinary team of curriculum experts, learning scientists, data analysts, and design researchers at Age of Learning conceptualized the Personalized Mastery Learning Ecosystem™ (PMLE™). The PMLE is a research-based framework that accounts for the complex interactions within a learner's environment, capturing relationships between people, processes, and data (Betts, Thai, & Gunderia, 2021). Providing teachers and parents with real-time data and individualized recommended activities is a central component of the PMLE and can empower teachers and parents as partners in learning.

In this report, we offer guidance for leaders who want to use technology and personalized learning programs to provide equitable learning in their districts:

- Start with a strong understanding of your district's current cultural and academic landscape.
- Consider and assess your learners' ecosystem early and often throughout the planning process.
- Empathize with your educator stakeholders and their pain points.
- Prioritize solutions that are co-designed with your stakeholders.
- Adopt solutions that foster collaboration across the learners' ecosystem.
- Choose research-based solutions with strong evidence of effectiveness that are a good fit for your learning environments.
- Empower all stakeholders in the ecosystem.

We conclude with an example of how one district improved outcomes by applying these principles.

# Reimagining the Approach to Education and Learning

Districts faced immense challenges over the last two school years. The global COVID-19 pandemic forced us to reimagine fundamental ideas about what learning looks like, where it occurs, and how it is delivered. Many classrooms shifted to distance learning or remote models where teachers held classes virtually. Districts tackled the digital divide head-on to support students who were learning from home by increasing access to devices, with many accelerating transitions to 1:1 device programs (Klein, 2021).

**In a recent Age of Learning study** of early childhood and elementary-level administrators, 67% of the district leaders surveyed stated that introducing new instructional delivery models or improving technology infrastructure became top priorities over the last two school years. Though device availability improved, concerns about equity remained as many students learned remotely while under-connected, often with limited access to reliable internet or computers preventing them from participating in class or completing assignments (Katz & Rideout, 2021). One consequence of being under-connected was this: Studies suggest as many as three million students—disproportionately, students already facing barriers to equitable education—did not participate in virtual learning in 2020 (Korman, O'Keefe, & Repka, 2021). Schools and districts now face the massive task of reengaging students who were left out while simultaneously meeting the academic, social, and emotional needs of all students.

During the 2020–2021 school year, parents and caregivers took on an expanded role in facilitating education at home, frequently without any teaching experience. This proved particularly challenging for parents who worked full-time, were caring for other children, or were less academically prepared themselves (Panaoura, 2020; Brossard et al., 2020). Not surprisingly, fewer K–8 students were on or above grade level in reading and mathematics compared to historic benchmarks. This was especially pronounced in schools serving students of color and schools in low-income urban areas.

### A Recent Age of Learning Study

During the summer of 2021, Age of Learning launched a study to understand district visions for technology as a result of the pandemic. With more than 200 district leaders participating to date, early results show developing the whole child and improving student equity as top priorities for districts, moving forward. We look forward to sharing more in-depth results in a future research brief.

*Studies suggest as many as three million students—disproportionately, students already facing barriers to equitable education—did not participate in virtual learning in 2020 (Korman, O'Keefe, & Repka, 2021).*

These experiences have made it clearer than ever that learning and child development do not occur in a vacuum but rather engage all of a child's social contexts (see Figure 1). The range of factors influencing learning can be viewed as a learning ecology, with the child at the center.

To address these challenges, districts adopted many digital tools intended to keep students engaged while learning remotely. Several education technology companies quickly offered solutions to help districts by providing their products at no cost during this time. However, educational researchers continue to emphasize the importance of choosing deliberate, well-designed solutions rather than whatever is available (Ewing & Cooper, 2021). As we enter a new school year with continued uncertainty and the dismaying legacy of the past two years, districts will need to reevaluate how best to support student learning and strategically adopt approaches such as personalization and mastery to promote equitable learning and empower all participants in a learner's ecosystem.

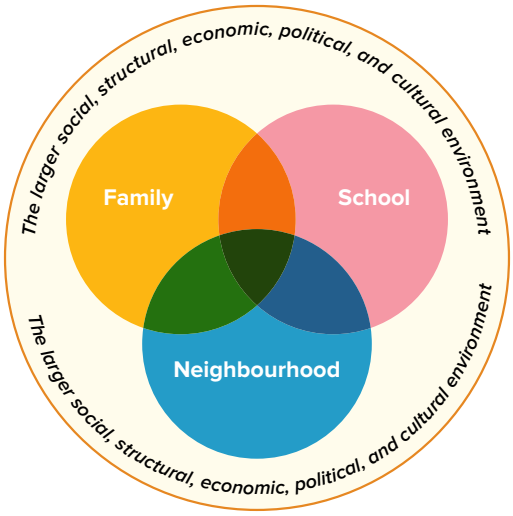



Figure 1. Bronfenbrenner, 1977

## Promoting Equity and Whole Child Development

Ecological frameworks play a significant role in **whole child development**. A comprehensive approach to supporting students engages educators, students, families, and communities to foster healthy development across various domains such as social-emotional outcomes, mental and physical health, and cognitive development (Wasser Gish, 2021). One strategy to promote equity within the classroom, especially for the most vulnerable of students, has been to consider how students' academic lives intersect with their lives outside the classroom and to shape instruction so it draws on students' experiences (Carter & Darling-Hammond, 2016; Lee, 2017; Ladson-Billings, 2006).

District leaders we surveyed ranked **whole child development** as a top priority for districts in future school years, an issue that has become more important because of the pandemic. Dr. Cynthia Tyson, a member of our Curriculum Board at Age of Learning and a Professor in the Department of Teaching and Learning at The Ohio State University, offers her perspective as to why that is the case:

> *"Every day, we are humans, being and becoming as we navigate living and learning in our world. In each of these encounters, our minds, bodies, and spirits are essential components, interconnected and interrelated, working together and simultaneously to help us make sense of the world. As children all dealt with the impact of the global health pandemic and racial injustice, just like adults, they engaged in their wholeness [in their] minds, bodies, and spirits to make sense of the world, especially school as it was turned upside down.*
>
> *More than ever, teachers and administrators worked to engage all aspects of what their students needed to navigate these changes. . . . Each of these domains must be individually and collectively addressed to support the resilience needed to navigate all the challenges presented while learning during the challenge of a global pandemic and racial injustice."*

*Ultimately, addressing unfinished learning will require a holistic approach that uses personalization to empower the entire ecosystem of the student (self, parent, teacher, technology).*

Understanding the connections among the learner, home, community, and school is critical for providing personalized and aligned supports for each child. As students return to school, there is growing concern for districts to focus on remediating **unfinished learning**, especially for students from disadvantaged backgrounds who were disproportionately impacted by the pandemic (Engzell, Frey, & Verhagen, 2021). Research examining unfinished learning in K–8 has called for a reevaluation of traditional remediation practices and a focus on sustainable solutions that extend beyond the classroom (Dorn et al., 2021). Ultimately, addressing unfinished learning will require a holistic approach that employs personalization strategies to empower the entire ecosystem of the student (self, parent, teacher, technology). At Age of Learning, we believe the educational technology and solutions that districts use to achieve student outcomes should also engage with the various stakeholders in a learner's ecosystem and build capacity through personalization.

## The Role of Personalization and Adaptive Technology

While engaged in remote learning, teachers and students accessed more digital tools and programs than ever before, including many curricular tools that use personalization or adaptive technology to differentiate learning. Our research shows that districts have a strong preference for these types of solutions: 80% of the district leaders we surveyed identified differentiated instruction as an essential feature when considering whether to adopt a digital solution. These types of tools and programs recognize that each learner is different and has unique needs. Because of this variability, one-size-fits-all solutions are inherently incapable of addressing the needs of all students in a classroom. This is even more true when students are disproportionately affected by disruptions, such as those experienced during the pandemic. By meeting students where they are, personalized learning solutions have the exciting potential to help schools and districts provide students with equitable academic experiences (Gardner, 1993, 2011).

We use the term "**unfinished learning**" instead of "learning loss" to avoid a deficit lens that places responsibility for the effects of disrupted schooling on the student and teacher while ignoring existing equity issues that were revealed during the pandemic. At Age of Learning, we are dedicated to promoting diversity, equity, and inclusion (DEI) throughout our work. As part of our commitment to DEI, our research takes an asset-based approach to education that focuses on the strength and resilience of students, parents, and educators in the face of systemic inequities.

These solutions demonstrate how adaptive technology can support student learning while helping teachers and informing instruction (Roschelle, Lester, & Fusco, 2020). While these technologies are certainly an excellent start, we believe it is important for digital tools and solutions to consider how personalization can move beyond differentiation in the classroom to empower the learner and their entire learning ecosystem.

## The Personalized Mastery Learning Ecosystem (PMLE)

Taking an interdisciplinary approach, Age of Learning curriculum experts, learning scientists, data analysts, and design researchers collaborated to conceptualize the Personalized Mastery Learning Ecosystem (PMLE, see Figure 2 from Betts, Thai, & Gunderia, 2021). The PMLE extends traditional notions of personalization and Bloom's theory of mastery learning by keeping the individual learner at the center while highlighting the interconnected, interdependent nature of the learning environment and learning as a process (Betts, Thai, & Gunderia, 2021; Bloom, 1968, 1984). In the PMLE, a learner interacts with learning materials that provide real-time assessments and adapt instruction dynamically to meet the learner's needs. Data collected through this process is also provided as actionable recommendations to the learner's teachers and parents or caregivers so the student's learning can be strengthened both in school and at home. The PMLE captures data from online and offline activities and incorporates it into the learner's profile. In this way, data collection is not isolated to a child's direct engagement with the system alone, but rather, it leverages additional data from both parents and teachers.

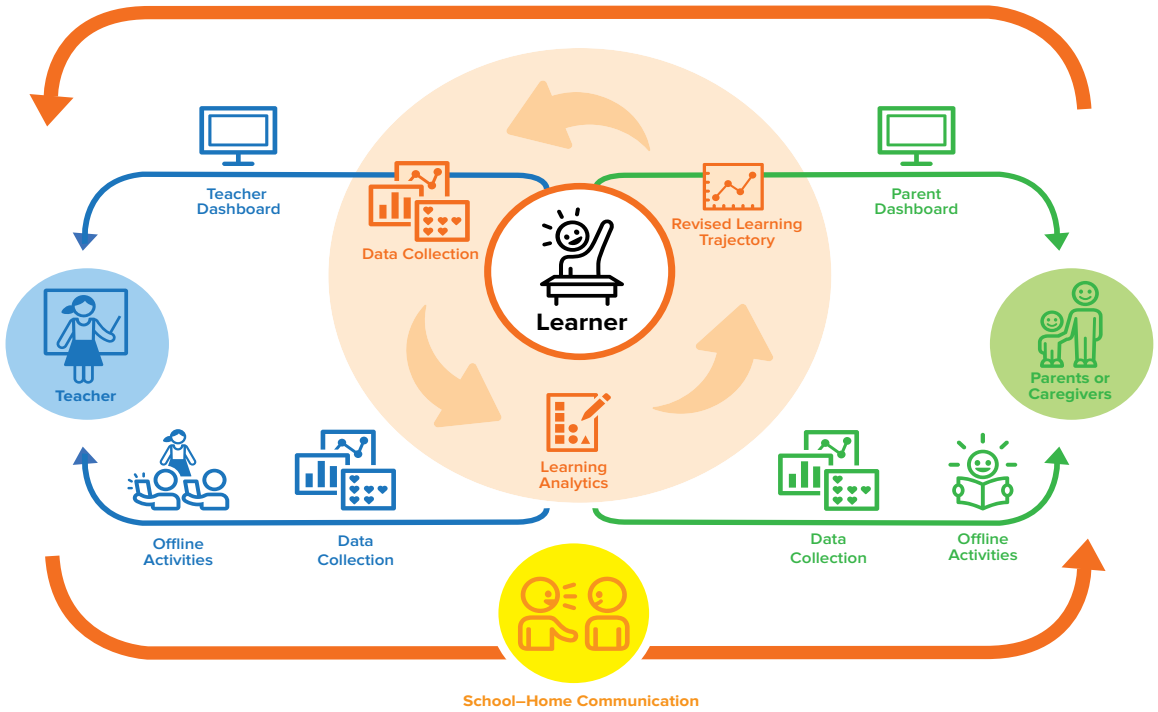



Figure 2. Personalized Mastery Learning Ecosystem (from Betts, Thai, & Gunderia, 2021)

An approach that centers on the PMLE may be especially relevant when extended learning opportunities (such as those necessary during the summer or after school) are essential to remediation and acceleration. Providing teachers and parents with actionable data through dashboards or individualized recommended activities is a central component of the PMLE and can empower teachers and parents as partners in learning. These recommendations allow teachers to inform their instruction and parents to better understand how the activities they complete with their children at home can also contribute to mastery. Findings from our recent pilot study and other **internal research** indicate PMLE dashboards and supplemental materials can be effectively used by educators to facilitate equitable instruction during major school interruptions. Educators reported that the data provided allowed them to easily identify students' areas of need, and 86% agreed that the program supported the development of individualized learning plans for their students (Thai & Bang, 2021). By building capacity in all areas of a child's ecosystem, we empower the adults who support learners in the classroom and at home so that personalized learning continues outside of school.

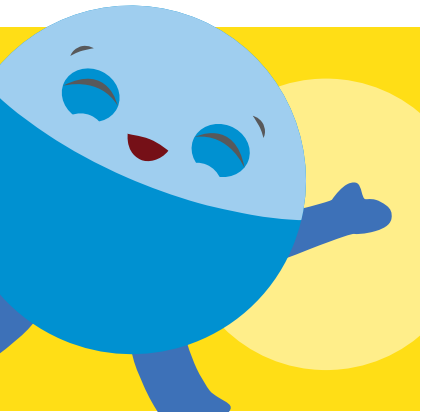
Studies show the potential impact that strategies to strengthen the connection between school and home can have, particularly during educational disruptions. Many parents, especially those of color and from low-income backgrounds, report remote learning led to closer relationships with teachers and greater awareness about their child's learning, while many educator preparation programs have strengthened their focus on building connections among teachers, students, and families (Barron et al., 2021; Darling-Hammond & Hyler, 2020).

**Internal research** conducted at Age of Learning shows the value teachers place on data and dashboards, specifically to help strengthen the connection between home and school:

> *"I'm actually going to use that data next week for parent conferences. We're going to use the data that we've collected from different things to explain to parents where their child is at this point in time. Like this is where they're strong, [and] this is where they struggle, so we can help them better understand where they may need to help their students at home. So that data makes a big difference, especially since my kids use it on regular basis."* *(Age of Learning, 2020b)*
>
> —Teacher

Parents also see value in actionable insights provided through dashboards. This parent appreciated the convenience of accessing learning resources through the Parent Center and expressed that it would fill a gap left from remote learning:

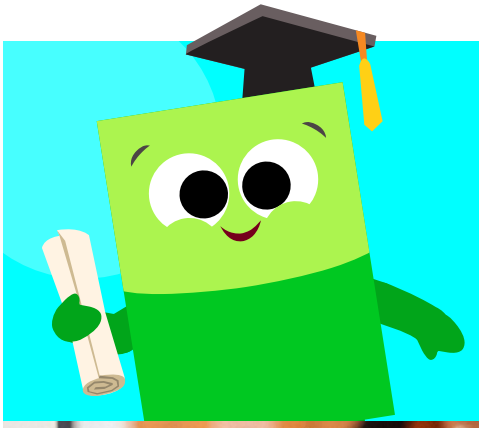
> *"That would make my life easier because then I wouldn't have to go on these different websites and print worksheets."* *(Age of Learning, 2020a)*
>
> —Mother



*By building capacity in all areas of a child's ecosystem, we empower the adults who support learners in the classroom and at home so that personalized learning continues outside of school.*


As schools reopen their doors during the 2021–2022 school year, educators and leaders find themselves needing to create learning plans for thousands of students who continue to experience further delays to in-person learning, such as those students required to quarantine after being exposed to or testing positive for COVID-19. Investing in PMLE solutions that supported distance learning during the pandemic may prepare districts for mitigating unfinished learning as a result of these and future unexpected school closures.

# Implementing Personalized Learning Technology: A Checklist for Districts



As students return to the classroom, school and district leaders are tasked with allocating funds toward solutions that address unfinished learning and support the students most disproportionately affected by the pandemic. After a wave of emergency funding, districts are currently in a state of reevaluation and are identifying solutions tailored to the specific needs of their student populations (Bakley & Cavanagh, 2021).

Considering a student's entire learning ecosystem as part of a district's technology planning and procurement processes is essential for times like these. In addition to meeting the needs of students and families, many educators felt overwhelmed with learning, teaching, and implementing new and unfamiliar technologies while also supporting a diversity of learning needs remotely. As educators transition back to the classroom, it is essential that digital tools streamline the process of identifying areas of unfinished learning for each learner. Additionally, as families play a more active role in supporting education during school closures, these same tools should strengthen the connection between teacher and caregiver so that personalized learning can continue at home—despite any extenuating family circumstances.

In reevaluating some of the emergency technology solutions adopted over the course of the last two school years or as districts consider purchasing new ones, here are a few strategies leaders can use to bring a holistic approach to technology and personalization to their districts.

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# Start with a strong understanding of your district's current cultural and academic landscape.

What products or solutions has your district purchased? What products do your students, educators, parents, and administrators actually use? Audit your current suite of classroom applications. Look for gaps and redundancies in categories and purpose of applications. Understanding what is currently in place can be a great starting point for conversations with stakeholders to better determine how systems are being used and how your stakeholders feel about the products that are available to them. Mapping existing products and solutions allows for a clear examination of whose needs are currently met by these solutions and where there are gaps. Additionally, how are these solutions aligned with your district's strategic goals? Outlining existing solutions can help districts ensure that their edtech purchasing practices are aligned with their district's vision for technology.

## Action Items

- Conduct a needs and usage assessment to identify current solutions in use.
- Identify any unmet needs and/or redundancies.
- Determine how/if solutions are aligned to district's strategic goals.

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## Consider and assess your learners' ecosystem early and often throughout the planning process.

Identifying which stakeholder voices and interests are represented at the table during the planning process is a central tenet of many change-management practices. It's equally important to consider whose voices are missing from the process. Similar concerns arise in the critical evaluation of technology solutions implemented during the pandemic. It is important to include all stakeholders in the decision-making process (Dexter, Francisco, & Luna, 2021). Additionally, engagement with stakeholders should not be limited to the start of the process. Districts should seek continuous feedback from stakeholders during and beyond the implementation period.

### Action Items

- Identify your stakeholders (students, parents, teachers, and school leaders such as the curriculum chair, the technology officer, the extended learning coordinator, the data manager, etc.).
- Create an advisory committee that includes a representative from each of your stakeholder groups to help make technology planning decisions.
- Meet and consult with your stakeholders throughout the planning process.
- Periodically check in with your stakeholders as solutions are implemented.

## Empathize with your educator stakeholders and their pain points.

Leaders must consider the implications these digital solutions have for the teachers who are responsible for their implementation. Teachers can find themselves overwhelmed with learning many different digital systems for their students, dealing with broken hardware or buggy software, and managing remote or hybrid instruction with students. While the pandemic has placed much stress on teachers, it has also changed teacher sentiment surrounding the utility of digital tools and increased their willingness to incorporate them in the classroom. While teachers are not a monolithic group, indications from our work and the work of others have signaled a generally greater willingness to use and invest in digital tools among elementary teachers. When considering whether to continue using or adopting a new system, engage with teachers to better understand their needs. What works best for their workflow, and what would make their jobs easier?

### Action Items

- Develop a forum to collect teacher feedback during planning and while implementing new solutions.
- Provide continuous professional development to support increasing teacher capacity and support implementation.
- Allow teachers adequate time to become better acquainted and proficient with new classroom tools. Understand that developing a successful technology strategy is an iterative process.

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## Prioritize solutions that are co-designed with your stakeholders.

In thinking about which solutions address pain points identified by stakeholders, consider products drawing from the voices of researchers, parents, educators, administrators, and students. Solutions co-designed in partnership with end-users may address these pain points in thoughtful ways. Human-centered design methodologies are common practice at Age of Learning. We regularly engage with end-users throughout our design process, rather than design based on what we think is best. For example, co-designing teacher-facing dashboards in collaboration with teachers and school administrators helped us create dashboards that effectively connect information across systems to serve different types of users (Sheehan, Rothschild, & Buchan, 2021). Additionally, through recent conversations with elementary school teachers, we identified several pain points with the technology solutions they currently use in their classrooms, including challenging interfaces and a need for more in-depth training. Our teams use this feedback to understand the growing needs of our stakeholders and better inform product design decisions from start to finish.

### Action Items

- Identify how solutions collect and incorporate feedback from your stakeholders.
- Determine the extent to which providers are are willing and able to adapt product delivery to meet the needs of your stakeholders.

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## Adopt solutions that foster collaboration across the learners' ecosystem.

A holistic approach to technology and personalization embraces the interconnected nature between school and home contexts. Products can enable such collaboration through sharing dashboards, teacher- recommended home-learning activities, or other methods that engage parents and other caregivers and connect them with educators. Additionally, solutions can facilitate direct communication between parents and teachers—increasing the access parents have to teachers and that teachers have to parents. In evaluating personalized technology solutions, districts can ask whether these solutions have the potential to lead to increased parent engagement.

### Action Items

- Determine if solutions include tools that support extending learning beyond the classroom.
- Collect feedback from parents and caregivers through an advisory group or other means during the planning process and throughout the school year.

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## Choose research-based solutions with strong evidence of effectiveness that are a good fit for your learning environments.

With so many options available to districts, which of the solutions in use or being considered has proven efficacy? If studies exist, are they conducted by independent organizations? It is equally important to consider who participated in these studies. Were these products found to be effective for students, teachers, and families who look like the stakeholders in your district? With federal policies emphasizing evidence-based decision-making as a best practice when adopting new technologies, and few educators indicating they rely on research evidence when selecting new tools, it is important that districts consider efficacy while planning or reevaluating purchases (Barton & Brown, 2021). Organizations such as Digital Promise provide resources to help districts evaluate technology research and find effective solutions (see Digital Promise's guide *Understanding Research in Ed-Tech*).

### Action Items

- Review existing efficacy studies for solutions under consideration.
- Determine whether findings could be applicable to your district's context by identifying the characteristics of the students, schools, and districts who participated in efficacy studies.
- Use resources from professional organizations, such as Digital Promise, to help critically evaluate efficacy studies.

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## Empower all stakeholders in the ecosystem.

Finally, does the solution provide supports for the students, parents, and teachers who will use it? Does the solution have opportunities for continuous professional development? Are there guided methods to empower or better strengthen pathways between learners and parents, learners and teachers, parents and teachers, or learners to other learners? Using digital tools and solutions should not be transactional, but rather a learning opportunity for all stakeholders. Students, educators, and parents can become more proficient digital citizens, better problem-solvers, and more growth-minded.

### Action Items

- Collect feedback from the students who use these solutions regularly. How do these solutions make students feel?
- Identify whether the solution provides professional development opportunities for all stakeholders.
- Determine whether professional development opportunities align with district professional development plans or priorities.

# A Checklist for Bringing an Equitable Approach to Personalized Technology to Your District

- ◯ Start with a needs and usage assessment to better understand the current edtech landscape in your district. 1
- ◯ Identify and consult with your stakeholders throughout the planning and implementation processes. 2
- ◯ Provide teachers with opportunities for professional development and to provide feedback—be patient and understand that teachers are a key piece of this iterative process. 3
- ◯ Establish how solutions incorporate feedback from users such as students, teachers, and parents and whether they can be flexible to meet your needs. 4
- ◯ Assess the extent to which solutions extend learning beyond the classroom and collect parent feedback to understand effectiveness. 5
- ◯ Critically evaluate existing efficacy studies to determine whether solutions would be appropriate for your district's context and stakeholders. 6
- ◯ Determine whether solutions include professional development supports for all stakeholders and if these supports align with district priorities. 7

# **Case Study:** Harlingen, TX

In the 2020–2021 school year, Age of Learning's My Math Academy program was piloted across 77 early childhood education classrooms in Texas's Harlingen Consolidated Independent School District (HCISD). As a Title 1 district, Harlingen schools serve students from low-income and rural backgrounds who were most susceptible to under-connected and unfinished learning during the pandemic. At the height of school closures, Harlingen administrators remained committed to providing high-quality education to their students and sought out solutions that would strengthen foundational math knowledge, help teachers identify their student needs, and facilitate personalized instruction for each student.

> "My Math Academy has resulted in tremendous results despite the pandemic . . . you can see our little ones are flourishing. It's because of our fabulous teachers [who] are using the data and the ability to put cutting-edge resources in front of them."
>
> —Harlingen administrator

My Math Academy was provided as a solution for more than 900 Pre-K3 and Pre-K4 students and their teachers. Our School Solutions team worked closely with Harlingen administrators and teachers, providing virtual training and webinars that supported an in-depth understanding of each aspect of the program.

As part of the Personalized Mastery Learning Ecosystem (PMLE), My Math Academy consists of three components designed to support the learner, teacher, and parent: (1) an adaptive system providing appropriate scaffolds across 130 game-based activities that address 96 math concepts, (2) a Teacher Dashboard providing real-time student data and recommended supplemental materials, and (3) resources that engage parents at home.

Young learners using the My Math Academy program made gains in math learning to a degree that Harlingen teachers and administrators said they had never seen before. **Mastery of math skills doubled for 4-year-olds and tripled for 3-year-olds, compared to prior knowledge assessments conducted at the start of the pilot.** Additionally, several pre-K students demonstrated exceptional growth across Texas state standards and performed at a 2nd grade level (Thai & Bang, 2022). Similar math gains were reported when we surveyed Harlingen teachers: **More than 90% reported that My Math Academy had a positive impact on math learning skills, including number identification and counting skills, and over 96% reported increases in children's levels of engagement, interest, and self-confidence in math learning (Thai & Bang, 2021).** Teachers agreed that the program enabled them to easily identify areas of need for each student and access supplemental materials that supported daily math instruction and aligned with instructional goals. When we interviewed teachers, many described the Dashboard as an essential support, allowing them to focus on differentiating instruction for their students.

Ultimately, Harlingen's experience provides strong evidence for the utility of My Math Academy's personalized learning system and adaptive Dashboards in empowering educators and students, effectively supporting math learning during a school year with many interruptions.

These results convinced the Harlingen administration and board to expand the My Math Academy program to all students in pre-K through 2nd grade.

# Conclusion

At Age of Learning, we believe the educational technology and solutions districts use to achieve student outcomes should also reflect a holistic approach to whole child development. That's why we are committed to developing partnerships with districts like Harlingen. Through the PMLE framework, we intend to improve equity for all learners by enabling students, teachers, and parents to collaborate in creating powerful and effective learning experiences, even through possible future disruptions. As districts reevaluate the technology solutions adopted over the last two school years and plan to implement new tools, let's work together to strengthen the system of support for all students and encourage a lifelong love of learning.

For more information, please visit

**www.AgeofLearning.com/schools**

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