2021–22 Annual Social Purpose Report

The Math Agency is a Washington based Social Purpose Corporation, which means that we are committed to our social mission above all else. One of the requirements of a Social Purpose Corporation is an annual report on our progress towards this goal.

Our mission is to close educational gaps in math for students from disadvantaged backgrounds. During the 2021-22 academic year, we made progress on this mission on several fronts. This progress can be roughly divided into two categories: *developing our capabilities* and *measuring our impact*.

Developing our capabilities

We are in the process of developing tools, infrastructure, and capabilities that we believe are essential to our mission. During the past year we made notable progress on the following:

Measuring Student Effort and Academic Growth

During our 2021 Summer Program, we built the tools needed to measure one important way our program can impact student effort: by changing how much students practice. We discovered that small pieces of our program (such as having effort-based competitions) can have a big impact on student motivation. For example, the data below demonstrates that these types of competitions can improve active practice time by 25-50%.
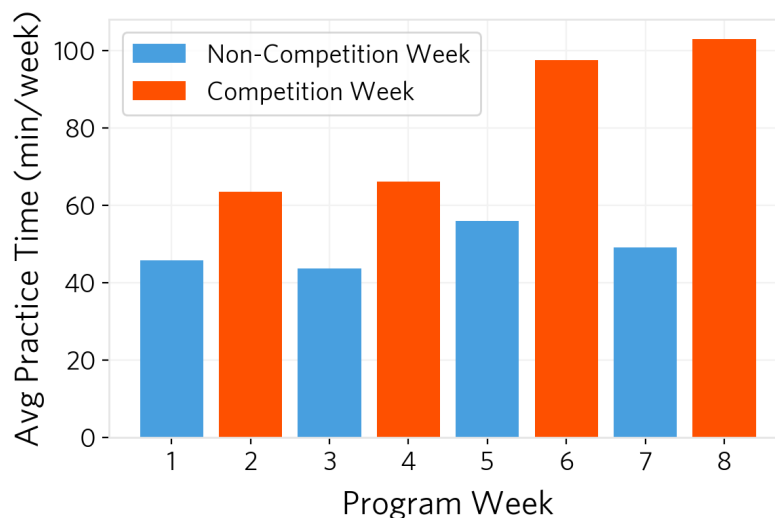
Figure 1. Average active practice time for students in an 8-week summer program. Every other week we ran an effort-based student competition.

Measuring Academic Growth

Closing educational gaps requires dramatically increasing how much students learn. Having good measurements of student learning is critical to this goal. This year we demonstrated that we have the tools to *quickly* and *accurately* measure students' skills (and growth) in math. In particular, we were able to show that the weekly assessments we performed using IXL's assessment tool matched both district and statewide standardized tests. Details can be found at: https://mpreiner.medium.com/how-well-do-weekly-math-assessments-match-up-to-standardized-tests-a86c2c1f26a9

Engaging Families

One high-leverage way to increase student effort is to encourage practice at home. With that in mind, this year we spent time building our capabilities to engage parents. We discovered that regular, personalized emails have the potential to increase family support for learning. Across our 3 pilot schools, email open rates averaged between 55% and 75%, and response rates averaged between 10%-15%.

We observed numerous cases of parent involvement driving student motivation. Generally this took the format of parents reminding or encouraging students to practice at home. Based on these results, we are further developing our family engagement infrastructure to include text messaging and formal practice reminders.

Measuring the Efficiency of Learning

The infrastructure we've created around measuring practice and growth can be naturally extended to measure learning *efficiency*. The chart below (a plot of academic growth as a function of practice) demonstrates this concept. The linear fit (shown as the gray dashed line) shows that on average, roughly 1.5 *additional* grades of learning are associated with every additional 60 minutes/week of practice. We can also see considerable variation between the various schools and students. Based on these results, we are currently exploring ways to increase the efficiency of learning for students in our program. More details can be found at https://mpreiner.medium.com/can-we-measure-the-efficiency-of-math-practice-c4173d59d84e
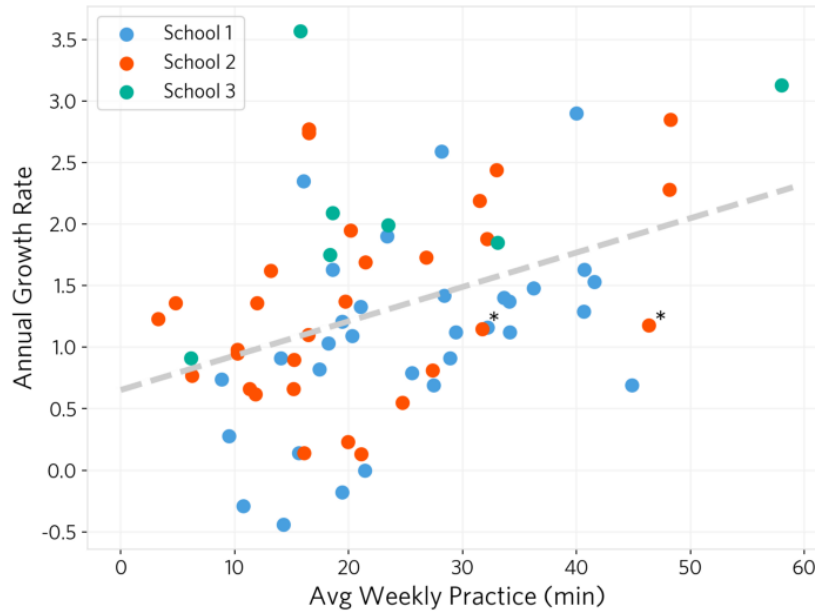
Figure 2. Annualized growth rate (assuming a 9-month school year) vs. practice for students in three different schools. Practice time is defined as time spent actively using digital learning tools.

Measuring our impact

Of course, the purpose of developing our technical capabilities is to use them to have a positive impact on student learning. This year we've seen several strong pieces of evidence that our program is helping to close educational gaps. The version of our program implemented in the 2021-22 school year consisted of three main components: small-group coaching, family engagement, and connections to teachers and classrooms. We ran the program with a little over 100 students in three different schools.

Doubling academic growth

After validating our ability to accurately measure academic skills with IXL, we used it to measure the growth of the students enrolled in our program. We were able to estimate students' *historic* growth during our initial skill assessment. For example, a 4th grade

student entering our program at a 2nd grade skill level has on average learned ~0.5 grades worth of math per year. By comparing students' skills at the end of our program to their initial skill levels, we were able to estimate their *current* growth rates.

On average, students entered our program having learned ~0.6 grade levels per year. While enrolled in our program, their growth rate was ~1.2 grade levels per year. **This means the average student doubled their academic growth rate while in our program.** More details on these results and individual school metrics can be found at: https://mpreiner.medium.com/2021-22-program-summary-ab61e28f575d

Closing educational gaps

While the increased growth rates were very encouraging, one potential explanation was a *universal* increase in student learning during the 2021-22 school year due to COVID-recovery. It could be that most students (regardless of enrollment in our program) were experiencing more learning after years of remote or interrupted instruction.

To better understand how our students' learning compared to Washington state as a whole, we ran a comparative analysis for our schools using statewide data from the Office of the Superintendent of Public Instruction (OSPI). Only one of our partner schools had a large enough fraction of students in the appropriate grades enrolled in our program to make a meaningful analysis. However, that partner school, Northgate Elementary, had the 2nd highest growth rate in the state of Washington. A histogram of student growth across all of the elementary schools in Washington is shown below in Figure 3.

Northgate also became the highest achieving school in the state for schools with more than 60% of students with low-income status, as can be seen in Figure 4 below.
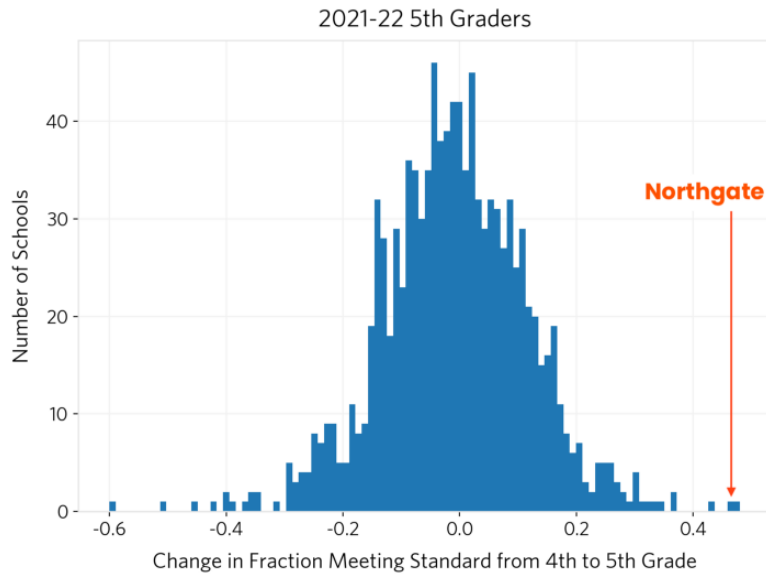
Figure 3. Histogram of the change in students meeting standards in math between 4th and 5th grade for all public schools in Washington state.
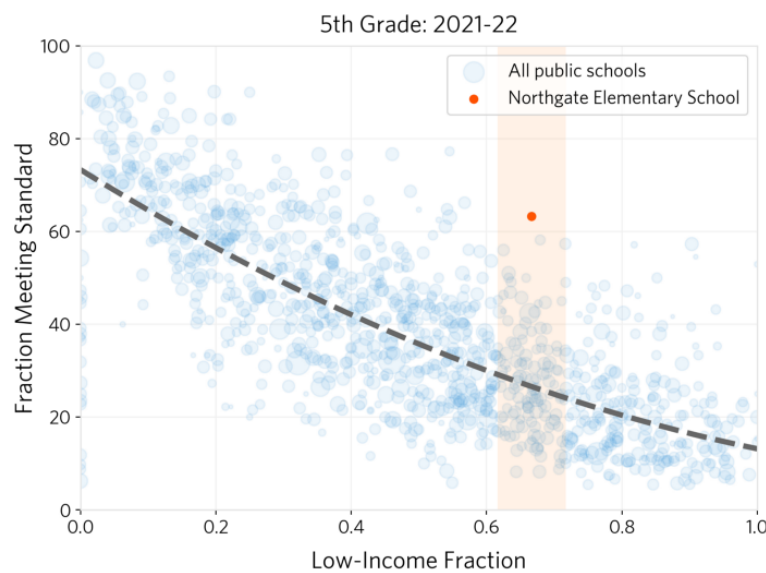

Figure 4. Chart showing the fraction of students meeting standards in math versus the fraction of low-income students for all of the 5th grade classes in Washington state. Dot size is proportional to the number of students enrolled. The dashed line shows a polynomial fit to the data. The orange band shows schools with low-income fractions within .05 of Northgate Elementary.

Important Caveats

While the results from 2021-22 are very encouraging, the following caveats are worth noting:

Sample sizes

Our sample sizes (a little over one hundred students and three schools) are still relatively small, and so we expect a material amount of measurement noise in our results.

Causality

Student growth is influenced by many things, including school-wide factors (building leadership, family engagement, after-school programs, etc.) and classroom factors (teachers and peer-related effects). We know that many of the students we work with benefit from great educators, and positive results are a result of the entire community.

Summary

During the 2021-22 academic year, The Math Agency made significant progress, not only on building infrastructure to increase our *future* impact, but also on demonstrating *immediate* progress on closing educational gaps in math for students from disadvantaged backgrounds. We believe this places us a strong position for continued success in our 2022-23 work.