

Math and Munch: The Expansion and Development of the Hamilton After-School Math Club



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Abstract and Roadmap

In this problem-solving learning (PSL) paper, I focus on the below-grade-level math achievement of most middle school students at Andrew Hamilton School in West Philadelphia. After providing background on this problem from various perspectives and sharing research on similar programs, I introduce Math and Munch, a 1-to-1 tutoring program that aims to strengthen the math skills of Hamilton middle school students. My program description includes the tutoring curriculum, information about lesson plans, and strategies for student engagement.

I then present an implementation plan that details the key agents and catalysts, provides a comprehensive timeline, and explains program evaluation and sustainability. I conclude the paper by reflecting on my PSL process.

Problem Statement

A vast majority of middle school students at Andrew Hamilton School possess below-grade-level mathematics skills. These learning gaps limit students' enjoyment of math, reduce students' connection to the classroom, and threaten the students' educational and employment prospects.

Personal Background and Motivation

Before elaborating on my problem statement, it is essential to discuss the motivation and rationale behind some of the central tenants of my problem-solving learning paper, or PSL.

I chose to center my program at Andrew Hamilton School because I had already established a connection to the school by virtually volunteering in Ms. Blagrove's 7th and 8th grade math classroom during the 20-21 academic year. I lacked a similar connection at other West Philadelphia schools, and I knew that my relationship with Ms. Blagrove could serve as the foundation for the growth of a larger program.

I decided to focus on math because of my passion for the subject and previous experience with math tutoring and lesson development. While other subjects — such as English or science — are also very important, I have a relatively weaker background in those fields. Math has helped me find joy and fulfillment in life, and I hope that all Hamilton students can reap similar benefits from the subject. This problem is important to me because I know that the students' level of math achievement will influence and shape their future endeavors.

More broadly, this project holds a special place in my heart because it connects and integrates so many parts of myself: my appreciation for math, my connection to Responsive Math Teaching, my love for Hamilton students, my co-leadership of Community School Student Partnerships, my time mentoring in Ms. Blagrove's classroom, and my invaluable experiences at Penn. To me, this paper represents more than an assignment for a class: it serves as a “whole-circle moment” for the first half of my undergraduate education at Penn. Working on this project has been a fun, enjoyable, and challenging experience, and I am truly excited to implement Math and Munch in the Fall of 2022.

Problem Details

National Context

The problem of middle school math achievement gaps at Andrew Hamilton School is part of the larger national problem of race- and income-based math achievement gaps. Thus, to fully understand the below-grade-level math achievement of Hamilton middle school students, it is essential to dive into the larger national context of middle school math achievement gaps. In the following section, I will explain the causes and characteristics of middle school math achievement gaps in the United States.

Despite some progress, low-income and minority middle school students obtain significantly lower math scores than their white or higher income peers. On the 8th grade math section of the 2019 National Assessment of Educational Progress, white students on average scored 32 points higher than Black students and 24 points higher than Hispanic students.¹ Although these gaps have narrowed since 1975, these 2019 race-based middle school math achievement gaps are larger than 0.5 standard deviations.² On the same 2019 national assessment, low-income 8th grade students — defined as those who qualify for free or reduced-price lunch — obtained an average math score of 266, while non-low-income 8th grade students obtained an average math score of 296.³ Scholars have debated how these income-based achievement gaps have changed over time: Hasim et al. reports that income-based achievement gaps for eighth grade students have narrowed by 0.15 standard deviations since 1990, while researcher Sean Reardon concludes that on average, income-based

¹ “National Student Group Scores and Score Gaps.” NAEP Report Card: Mathematics, The National Assessment of Educational Progress. <https://www.nationsreportcard.gov/mathematics/nation/groups/?grade=8>.

² “Racial and Ethnic Achievement Gaps,” The Educational Opportunity Monitoring Project, Stanford Center for Education Policy Analysis, <https://cepa.stanford.edu/educational-opportunity-monitoring-project/achievement-gaps/race/>.

³ The National Assessment of Educational Progress, “National Student Group Scores and Score Gaps.”

achievement gaps have grown by about 40% over a similar time period.⁴ Scholars often distinguish between income-based and race-based achievement gaps, but these two concepts converge in the lives of low-income Black or Hispanic middle school students.

These middle school math achievement gaps do not appear in 6th grade. Instead, they begin in childhood due to disparities in families' socioeconomic statuses. In their first years of parenting, higher-income parents often leverage substantial financial resources to provide greater enrichment to their children through high-quality childcare and preschool, while low-income and minority families often lack the time and money required to provide similar opportunities.⁵ A disproportionate number of minority children also experience the negative developmental consequences of growing up with an incarcerated parent.⁶ Due to these inequalities in students' first home and school experiences, there are substantial differences in students' math achievement from a very young age. In a 2010 study examining students' math scores at the beginning of kindergarten, high-SES students' scores were more than a standard deviation above those of their low-SES peers.⁷ Another study focused on racial achievement gaps reported that class inequalities explained about three-fourths of the kindergarten

⁴ Shirin Hashim, Thomas Kane, Thomas Kelly-Kemple, Mary Laski, and Douglas Staiger, "Have Income-Based Achievement Gaps Widened or Narrowed?," National Bureau of Economic Research (August 2020): https://www.nber.org/system/files/working_papers/w27714/revisions/w27714.rev0.pdf; Sean Reardon, "No Rich Child Left Behind," *The New York Times*, April 27th, 2013, <https://opinionator.blogs.nytimes.com/2013/04/27/no-rich-child-left-behind/>; Jill Barshay, "Inside the Reardon-Hanushek Clash Over 50 Years of Achievement Gaps," *Hechinger Report*, May 27th, 2019, <https://hechingerreport.org/inside-the-reardon-hanushek-clash-over-50-years-of-achievement-gaps/>.

⁵ Sabrina Tavernise, "Education Gap Grows Between Rich and Poor, Studies Say," *The New York Times*, February 9th, 2012, <https://www.nytimes.com/2012/02/10/education/education-gap-grows-between-rich-and-poor-studies-show.html#:~:text=No%2C%20in%20analyses%20of%20long,substantially%20during%20the%20same%20period>.

⁶ Anna Egalite, "How Family Background Influences Student Achievement," *Education Next* 16, no. 2 (Spring 2016): <https://educationnext.org/how-family-background-influences-student-achievement/>; Eric Hanushek, Paul Peterson, Laura Talpey, and Ludger Woessmann, "The Achievement Gap Fails to Close," *Education Next* 19, no. 3 (Summer 2019): <https://www.educationnext.org/achievement-gap-fails-close-half-century-testing-shows-persistent-divide/>.

⁷ Emma Garcia and Elaine Weiss, "Reducing and Averting Achievement Gaps," *Economic Policy Institute*, September 27th, 2017, <https://www.epi.org/publication/reducing-and-averting-achievement-gaps/>.

black-white math achievement gap.⁸ While income-based kindergarten achievement gaps have narrowed over time, socioeconomic disparities clearly plant the seed for middle school math achievement gaps at a young age.⁹

Class inequalities also sustain these early math achievement gaps into elementary school and middle school. Better-educated parents — a primarily higher-income demographic — are more likely to consider the quality of their local schools and ensure that their school is meeting their child's needs.¹⁰ High-status, well-resourced families can also provide a greater number of summer and extracurricular experiences for their children.¹¹ On the other hand, students from low-income and minority families are more likely live in high-poverty neighborhoods, where exposure to poverty can reduce children's mathematical growth by the equivalent of 0.75 years of schooling over a five year period.¹² Neighborhood factors such as crime and violence also impede the academic growth of low-income and minority students.¹³

Race- and income-based middle school math achievement gaps also stem from unequal educational experiences. In comparison to their higher-income white and Asian counterparts, low-income and minority middle school students are more likely to be concentrated in high-poverty schools: in 2013, 43.5 percent of Black 8th grade students and 55.8 percent of 8th

⁸ David Quinn, "Kindergarten Black-White Test Score Gaps: Re-examining the Roles of Socioeconomic Status and School Quality with New Data," *Sociology of Education* 88, no. 2: 120-139, <https://www.asanet.org/sites/default/files/savvy/journals/soe/Apr15SOEFeature.pdf>.

⁹ Miriam Wasserman, "Ready for Kindergarten? Gap Between Rich and Poor Narrows, Stanford Study Finds," *Stanford News*, August 26th, 2016, <https://news.stanford.edu/2016/08/26/kindergarten-ready-gap-rich-poor-narrows/>; National Assessment of Educational Progress, "National Student Group Scores and Score Gaps."

¹⁰ Anna Egalite, "How Family Background Influences Student Achievement."

¹¹ Anna Egalite, "How Family Background Influences Student Achievement."

¹² Francis A. Pearman, "The Effect of Neighborhood Poverty on Math Achievement: Evidence from a Value-Added Design," *Education and Urban Society* 51, no. 2: 289-307, <https://doi.org/10.1177/0013124517715066>.

¹³ Richard Rothstein, "The Racial Achievement Gap, Segregated Schools, and Segregated Neighborhoods — A Constitutional Insult." *Economic Policy Institute*, November 12th, 2014, <https://www.epi.org/publication/the-racial-achievement-gap-segregated-schools-and-segregated-neighborhoods-a-constitutional-insult/>.

grade Hispanic English language learners attended a school where over 76% of students qualified for free or reduced-price lunch.¹⁴ In these predominantly low-income and minority schools, students have access to a weaker curriculum, less qualified teachers, and lower quality learning materials, causing them to achieve at lower levels.¹⁵ Researchers Martin Conroy and Emma Garcia found that a one percent increase in a school's level of economic disadvantage in 2013 was associated with a statistically significant 0.07 standard deviation decline in 8th grade students' math achievement and small negative effect on the black-white test math score gap.¹⁶ Moreover, among 15 other measures of segregation, the disparity in average school poverty rates between the schools of grades 3-8 white and black students is most powerfully correlated with achievement gaps, highlighting that school segregation is a key determinant of achievement gaps for current and rising middle school students.¹⁷

Middle school math achievement gaps are also shaped and influenced by students' personal mindsets about their intelligence. Research shows that stereotype threat and internalized beliefs about ability can impede students' capacity to perform at higher levels.¹⁸ Jo Boaler, a professor at Stanford University, also describes how a core myth in mathematics — that only “math people” can achieve at high levels — decreases students' learning and

¹⁴ Martin Carnoy and Emma Garcia, “Five Key Trends in US Student Performance,” *Economic Policy Institute*, January 12th, 2017, <https://www.epi.org/publication/five-key-trends-in-u-s-student-performance-progress-by-blacks-and-hispanics-the-takeoff-of-asians-the-stall-of-non-english-speakers-the-persistence-of-socioeconomic-gaps-and-the-damaging-effect/>.

¹⁵ Clarence Johnson and William Kritsonis. “The National Dilemma of African American Students: Disparities in Math Achievement and Instruction,” *National Forum of Applied Educational Research Journal* 20, no. 3 (2006): <https://files.eric.ed.gov/fulltext/ED492116.pdf>.

¹⁶ Martin Carnoy and Emma Garcia, “Five Key Trends in US Student Performance.”

¹⁷ Sean Reardon, “School Segregation and Racial Academic Achievement Gaps,” *RSF: The Russell Sage Foundation Journal of the Social Sciences* 2, no. 5 (2016): 34-57, <https://www.rsfsjournal.org/content/rsfiss/2/5/34.full.pdf>.

¹⁸ “Common Causes of Achievement Gaps.” PD Services, Corwin, <https://us.corwin.com/en-us/nam/equity-causes-of-achievement-gaps>.

achievement.¹⁹ The strong connection between a student's math achievement and their math mindset will be discussed throughout this PSL.

The COVID-19 pandemic has influenced math achievement gaps for current middle school students. During the initial outbreak and transition to online schooling, minority students had disproportionately less access to the digital technology required to continue with their education.²⁰ Moreover, even if Black or Latinx students had devices, these students were twice as likely as white students to have no live access to a teacher.²¹ Among current 7th grade students, those attending majority-white schools learned 53% of the math content that they would have otherwise learned, while those attending schools with a majority of students of color attained less than 37% of expected math achievement.²² Researchers have also shown that 6th grade income-based math achievement gaps grew by 6% between 2019 and 2021.²³ That said, these results should be interpreted with caution, as some studies have reported that middle school math achievement gaps did not widen — and possibly even narrowed — during the pandemic.²⁴

Along with class inequality, unequal educational experiences, students' personal mindsets about intelligence, and the COVID-19 pandemic, several other important factors also

¹⁹ Jo Boaler, Jack Dieckmann, Graciela Perez-Nunez, Kathy Liu Sun, and Cathy Williams, "Changing Students' Minds and Achievement About Mathematics: The Impact of a Free Online Course," *Frontiers in Education*: pg. 26.

²⁰ Sarah Mervosh, "The Pandemic Hurt These Students the Most," *New York Times*, September 7th, 2021, <https://www.nytimes.com/2021/07/28/us/covid-schools-at-home-learning-study.html>.

²¹ Emma Dorn, Bryan Hancock, Jimmy Sarakatsannis, and Ellen Viruleg, "COVID-19 and Learning Loss — Disparities Grow and Students Need Help," *McKinsey*, December 8th, 2021, <https://www.mckinsey.com/industries/public-and-social-sector/our-insights/covid-19-and-learning-loss-disparities-grow-and-students-need-help>.

²² Emma Dorn, Bryan Hancock, Jimmy Sarakatsannis, and Ellen Viruleg, "COVID-19 and Learning Loss — Disparities Grow and Students Need Help."

²³ Megan Kuhfeld, James Soland, and Karyn Lewis, "Test Score Patterns Across 3 COVID-19 Impacted School Years," EdWorking Paper (2022): <https://www.edworkingpapers.com/sites/default/files/ai22-521.pdf>.

²⁴ Karyn Lewis, Megan Kuhfeld, Eric Ruzek, and Andrew McEachin. Learning During COVID 19: Reading and Math Achievement in the 20-21 School Year," Center for School and Student Progress, <https://www.nwea.org/content/uploads/2021/07/Learning-during-COVID-19-Reading-and-math-achievement-in-the-2020-2021-school-year.research-brief-1.pdf>

drive middle school math achievement gaps, such as school tracking systems and a lack of culturally responsive teaching practices.²⁵ This broader explanation of income- and race-based middle school math achievement gaps is a valuable first step in understanding the below-grade-level math achievement of Hamilton middle school students.

²⁵ "Common Causes of Achievement Gaps," Corwin.

Local Context: The School District of Philadelphia

In the previous section, I detailed the problem of income- and race-based middle school math achievement gaps in the United States. In the following section, I will build on this context and illustrate how this problem is manifested in the School District of Philadelphia (SDP), home of the Andrew Hamilton School.

As asserted, on average in the United States, low-income and minority middle school students obtain substantially lower math scores than their white, Asian, and higher-income peers. A comparison between the City of Philadelphia and its neighboring suburb, Lower Merion, provides a vivid example of the strong connections between race, socioeconomic status, and middle school math achievement. In the Lower Merion School District (LMSD), 8% of students come from low-income families, 74% of students are white, and 72% of middle school students meet math proficiency standards.²⁶ By contrast, in the School District of Philadelphia (SDP), about 74% of middle school students identify as Black or Latinx, a majority of students qualify for free and reduced-price lunch, and 22.1% of eighth grade students met math proficiency standards in 2021.²⁷ The 22.1% proficiency rate of SDP 8th grade students comes on the heels of declining 8th grade math proficiency rates since 2012-13.²⁸ The contrast between eighth-grade achievement in LMSD and SDP highlights the relevance of the race- and income-based middle school math achievement gaps in the broader Philadelphia area.

²⁶ “Lower Merion School District,” K-12 Education, US News and Education, <https://www.usnews.com/education/k12/pennsylvania/districts/lower-merion-sd-103199#:~:text=Overview%20of%20Lower%20Merion%20School%20District&text=Also%2C%207.9%25%20of%20students%20are%20economically%20disadvantaged.>

²⁷ “School Information,” District Performance Office, Philadelphia School District, https://www.philasd.org/performance/programsservices/open-data/school-information/#school_lists.

²⁸ District Scorecard.” District Performance Office, <https://www.philasd.org/performance/programsservices/school-progress-reports/district-scorecard/#note>.

Race- and income-based middle school math achievement gaps are also prevalent within the Philadelphia School District. At Center City’s Julia Masterman School — where 38% of students are economically disadvantaged and 43% of students are white — about 95% of middle school students achieved math proficiency on the Pennsylvania System of School Assessment (PSSA) test in 2018-19.²⁹ By contrast, at Woodrow Wilson Middle School, where all students qualify as economically disadvantaged and 93% of students come from minority backgrounds, 21% of students achieved PSSA math proficiency in 2018-19.³⁰ This race- and income-based achievement pattern holds throughout the district.

The below-grade-level math achievement of low-income and minority SDP middle school students largely stems from the students’ comparatively lower access to educational resources. In response to a question asking if there is any reason why Philadelphia students cannot reach the achievement levels of students in Lower Merion, Philadelphia superintendent William Hite said, “Other than funding, no, and making sure young people have access to the type of resources Lower Merion enjoys.”³¹ Dr. Hite is referring to a stark disparity in funding: Lower Merion spends almost \$27,000 per student, while the School District of Philadelphia spends less than \$20,000 per student.³²

²⁹ 2018-19 End of Year Report: Julia Masterman School. School District of Philadelphia, https://cdn.philasd.org/offices/performance/SPR_Files/2019-2020/Reports/2140_MS_EOYR_SY1920.pdf; “Julia R Masterman Sec School,” School Digger, Philadelphia City School District, <https://www.schooldigger.com/go/PA/schools/1899003808/school.aspx#:~:text=Compare%20Details%20Student%20population%20at,a%20free%20or%20discounted%20lunch>; “Julia R. Masterman School (Middle-High),” School Profiles, School District of Philadelphia, <https://schoolprofiles.philasd.org/masterman/demographics>.

³⁰ “Woodrow Wilson School (Middle),” School District of Philadelphia, <https://schoolprofiles.philasd.org/wwilson/overview>; “Woodrow Wilson Middle School,” K-12 Education, <https://www.usnews.com/education/k12/new-jersey/woodrow-wilson-middle-school-270335>.

³¹ Dale Mezzacappa, “Hite Testifies Lack of Resources Hold Back Philly Students,” *Chalkbeat*, January 11th, 2022, <https://philadelphia.chalkbeat.org/2022/1/11/22879306/hite-testifies-lack-of-resources-holds-back-philly-students#:~:text=Philadelphia%20school%20superintendent%20William%20Hite,achieve%20academically%20at%20high%20levels>.

³² Dale Mezzacappa, “Hite Testifies Lack of Resources Hold Back Philly Students.”

Funding inequities and resource disparities in the School District of Philadelphia have tangible implications for the math achievement of middle school students. SDP first-year teachers without a bachelor's degree are paid an annual salary of \$48,500, while similarly-qualified teachers in Lower Merion with the same level of experience are paid \$56,234.³³ This contrast incentivizes the most highly qualified teachers to teach in the suburbs, a consequence that threatens the instructional quality provided to SDP middle school students.³⁴ Middle schools with high percentages of low-income and minority students also face greater staffing challenges: the predominantly low-income and minority Woodrow Wilson Middle School has a 31:1 student-teacher ratio, while Masterman's middle school and high school has a 24:1 average student-teacher ratio.³⁵ Although some evidence suggests otherwise, a large amount of research concretely links smaller class sizes — such as those at Julia Masterman — to higher academic achievement.³⁶

Several other factors also contribute to income- and race-based achievement gaps in Philadelphia. School attendance, a factor strongly correlated with achievement, is substantially lower at schools serving higher proportions of low-income and minority students. A comparison between Woodrow Wilson and Masterman also provides a clear example of this trend. In the

³³ "Salary Schedule Effective September 1, 2021," The School District of Philadelphia, https://www.pft.org/sites/default/files/article_pdf_files/2021-10/21-22_pay_scale.pdf. "20-21 LMEA Salary Schedules," Lower Merion School District, https://www.lmeaonline.org/documents/contracts/2020-21_LMEA_Salary_Schedules.pdf.

³⁴ Heather Hough, "Salary Incentives and Teacher Quality: The Effect of a District-Level Salary Increase on Teacher Recruitment." (2012): <https://cepa.stanford.edu/content/salary-incentives-and-teacher-quality-effect-district-level-salary-increase-teacher-recruitment>.

³⁵ "Woodrow Wilson Middle School," Niche, <https://www.niche.com/k12/woodrow-wilson-middle-school-philadelphia-pa/>; "Julia R. Masterman Secondary School," US News and Education, <https://www.usnews.com/education/best-high-schools/pennsylvania/districts/philadelphia-city-school-district/julia-r-masterman-secondary-school-17216>.

³⁶ Matthew M. Chingos and Grover J. "Russ" Whitehurst, "Class Size: What Research Says and What it Means for State Policy," *Brookings*, May 11th, 2021, <https://www.brookings.edu/research/class-size-what-research-says-and-what-it-means-for-state-policy/>.

20-21 school year, 80% of Woodrow Wilson students attended 95% or more school days, while 99% of middle and high school students at Masterman reached the same attendance benchmark.³⁷ Moreover, middle school students living in low-income neighborhoods in Philadelphia are more likely to experience the achievement-lowering impacts of exposure to crime and violence.³⁸ Their families also have fewer financial resources to support their students' academic growth outside the classroom.³⁹

The COVID-19 pandemic has also negatively affected the math achievement of low-income and minority students in Philadelphia middle schools. In an in-depth report with PBS, Anuar, a middle school student at the predominantly low-income Southwark School, described his frustration with online school:

“What bothers me most is that if I fail seventh grade I’m going to go to a bad high school. I don’t want to be online; I want to be in normal class. I could be killing [it in in-person school], but if it’s online, I might fail.”⁴⁰

Anuar noted that math and English felt compelling, but overall, he “[didn’t] feel like [he was] learning anything.”⁴¹ Although some students’ were able to increase their math skills during the pandemic, Anuar’s story was common for many low-income and minority students in the school district. Evelyn Nunez, The School District of Philadelphia’s Chief of Academics, summed up the trend succinctly, explaining that “the absence of in-person learning has

³⁷ “Julia R. Masterman School,” School District of Philadelphia; “Woodrow Wilson School,” School District of Philadelphia.

³⁸ “Philadelphia’s Poor: Experiences from Below the Poverty Line.” *Pew Trusts*, September 26th, 2018, <https://www.pewtrusts.org/en/research-and-analysis/reports/2018/09/26/philadelphias-poor-experiences-from-below-the-poverty-line>; ; Amy Ellen Schwartz, Agustina Laurito, Johanna Lacoe, Patrick Sharkey, and Ingrid Gould Ellen, “The Academic Effects of Exposure to Neighborhood Violence,” Center for Policy Research at the Maxwell School, Working Paper, no. 195, https://www.minneapolisfed.org/~media/files/community/2017-conference/papers-and-presentations/concurrent1/schwartz_paper2_crime_508.pdf?la=en.

³⁹ “Philadelphia’s Poor: Experiences from Below the Poverty Line”

⁴⁰ Caroline Preston, “How Four Middle Schoolers Are Navigating the Pandemic,” *PBS*, January 26th, 2021 <https://www.pbs.org/newshour/education/how-four-middle-schoolers-are-navigating-the-pandemic>.

⁴¹ Caroline Preston, “How Four Middle Schoolers Are Navigating the Pandemic.”

disproportionately affected our most vulnerable children, which are low-income and minority students.”⁴² According to most recent testing data, the district saw a roughly 10 percentage point decline in 8th math proficiency scores between 2019 and 2021.⁴³

As shown, race- and income-based middle school math achievement gaps are very prevalent within the School District of Philadelphia. These SDP achievement gaps are caused by a combination of several factors, such as school funding inequality, socioeconomic disparities among students, the COVID-19 pandemic, and gaps in student attendance.

⁴² Mike Denardo, “Philly Schools Measuring the Academic Impact of COVID-19 School Closures,” KYW News Radio, October 21st, 2020, <https://www.audacy.com/kywnewsradio/news/local/philly-schools-measure-academic-impact-of-covid-19-closures>.

⁴³ Maddie Hanna and Kristen Graham, “Scores on PA Standardized Tests Fell in 2021, But Many Students Didn’t Take Them,” *Philadelphia Inquirer*, March 4th, 2022, <https://www.inquirer.com/news/pssa-results-2021-keystones-standardized-tests-20220304.html>.

School Context: The Andrew Hamilton School

In the preceding two sections, I described the problem of middle school math achievement gaps in the United States and the School District of Philadelphia. In this section, I will zoom in further to and provide a detailed explanation of the below-grade-level math achievement of many middle school students at Andrew Hamilton School in West Philadelphia, where 99.6% of students are Black or Latinx and all students come from low-income families.⁴⁴ This problem is a direct outgrowth of the national and citywide problems of race- and income-based middle school math achievement gaps.

Almost all middle school students at Andrew Hamilton School possess below grade-level math skills. According to March 2022 math testing data for one of Ms. El Sada Blagrove's 7th grade math classes, only one student in the class is learning at grade level, while the math skills of about half the class (10 out of 21 students) are at least three grade levels below 7th grade standards.⁴⁵ In an interview, Ms. Tamara Jones, Hamilton's 6th grade math teacher, described how many of her students do not know multiplication facts, a required skill for a majority of middle school math concepts.⁴⁶ She also estimated that about 98% of her students were learning below grade level.⁴⁷

These math learning gaps detrimentally impact the classroom experiences and educational outcomes of Hamilton middle school students. Ms. Jones described how Hamilton middle school students with below-grade-level math skills do not try as hard in the classroom,

⁴⁴ "Hamilton Andrew School," US News and World Report.

<https://www.usnews.com/education/k12/pennsylvania/hamilton-andrew-school-232382#:~:text=Overview%20of%20Hamilton%20Andrew%20School&text=The%20school's%20minority%20student%20enrollment,enrolls%20100%25%20economically%20disadvantaged%20students>.

⁴⁵ El Sada Blagrove, "Interview with Om Manghani," interview by Om Manghani, April 8th, 2022.

⁴⁶ Tamara Jones, "Interview with Om Manghani," interview by Om Manghani, March 17th, 2022.

⁴⁷ Tamara Jones, "Interview with Om Manghani."

as they lack confidence in their ability to complete tasks.⁴⁸ The scholars' diminished sense of efficacy in turn sustains these math learning gaps over time, as the students do not comfortably tackle math tasks on their own.⁴⁹ Low math achievement also threatens the students' smooth progression into 7th grade, 8th grade, or high school.

There are several causes of below-grade-level middle school math achievement at Hamilton. In a virtual interview, Mr. Wade Robinson, Hamilton's math instructional lead, explained his belief that Hamilton advances too many students with weak math skills to the next grade level.⁵⁰ Additionally, infrequent and uneven class attendance contributes to students' below-grade-level math achievement, as students with low levels of attendance do not spend as much time learning new material or reinforcing old skills.⁵¹ Gaps in students' math knowledge also stem from the compounding nature of the math curriculum.⁵² Specifically, math concepts build on each other, so initial math learning gaps are sustained when new material is introduced in middle school.⁵³ While my Hamilton-specific interviews did not touch on the impacts of poverty, violence, and crime on the math achievement of middle school students, these factors certainly influence academic achievement as noted in the preceding section.

Mr. Robinson and Ms. Blagrove also attributed the middle school students' below-grade-level achievement to Hamilton's new math curriculum. Hamilton recently switched from a centralized core curriculum to a diversified model that integrates resources from Illustrative Math, Engage New York, and Envision Math.⁵⁴ This change was frustrating for Ms.

⁴⁸ Tamara Jones, "Interview with Om Manghani."

⁴⁹ Tamara Jones, "Interview with Om Manghani."

⁵⁰ Wade Robinson, "Interview with Om Manghani," interview by Om Manghani, March 17th, 2022.

⁵¹ Wade Robinson, "Interview with Om Manghani."

⁵² Eros Uthman-Olukun, "Interview with Om Manghani," interview by Om Manghani, March 30th, 2022.

⁵³ Eros Uthman-Olukun, "Interview with Om Manghani."

⁵⁴ El Sada Blagrove, "Interview with Om Manghani," interview by Om Manghani, February 23rd, 2023.

Blagrove, as the new curriculum expected an unrealistic pacing schedule and did not provide time for her to adequately help students with below-grade level math skills tackle grade level concepts.⁵⁵ In Mr. Robinson's eyes, the curriculum is too conceptual and skips the required step of procedural knowledge.⁵⁶ Both Mr. Robinson and Ms. Blagrove desire a curriculum that explains grade-level concepts in a stepwise and linear fashion.⁵⁷

The COVID-19 pandemic exacerbated the below-grade-level math achievement of Hamilton middle school students. As a volunteer in Ms. Blagrove's 7th and 8th grade math classroom during the 20-21 academic year, I learned that several students did not attend class, and among those who did, only a handful of students were able to actively participate. The students' limited engagement was often due to other responsibilities, obligations, or interests, and it was hard for Ms. Blagrove to reach all the students and support their growth. After returning to the classroom after about a year of virtual learning, students did not have long attention spans or experience with necessary classroom skills, such as knowing how to use a calculator.⁵⁸ Students also lacked necessary math skills for middle school concepts.⁵⁹ That said, the students who frequently participated during the pandemic emerged with strong middle school math skills.

In sum, almost all middle school students at Andrew Hamilton School possess below-grade-level math skills. It is important to note that the students should not be blamed for their low levels of academic achievement. Structural factors — such as the middle school

⁵⁵ El Sada Blagrove, "Interview with Om Manghani."

⁵⁶ Wade Robinson, "Interview with Om Manghani."

⁵⁷ Wade Robinson, "Interview with Om Manghani;" El Sada Blagrove, "Interview with Om Manghani."

⁵⁸ El Sada Blagrove, "Interview with Om Manghani."

⁵⁹ El Sada Blagrove, "Interview with Om Manghani."

curriculum, financial insecurity, and the COVID-19 pandemic — have created and sustained this below-grade-level achievement.

The Importance of Addressing Math Learning Gaps

In the previous section, I provided an overview of my problem, the below-grade level math achievement of middle school students at Andrew Hamilton School. In the following section, I will show how this low math achievement represent a significant and strategic problem. If local place-based partnerships can substantially alleviate this problem, Hamilton middle school students will benefit in several ways.

First, strong math education is closely related to students' cognitive development and day-to-day lives. When learning math, students develop logical reasoning, mental rigor, creativity, and critical thinking skills.⁶⁰ Math is central to several important life routines, such as shopping, home repair, banking, and cooking.⁶¹ Math skills also directly impact decisions about budgeting, saving, and borrowing: in a study focused on the impact of numeracy skills on wealth, researchers found that a one-point increase in respondents' numeracy score was associated with an average 5 percent increase in wealth.⁶² During middle school, math knowledge also helps students understand other middle school subjects, such as science, social studies, music, and art.⁶³ Given that math education impacts several key aspects of students' lives, it is important to invest in bolstering the math achievement of middle school students at Hamilton.

⁶⁰ "The Role of Mathematics in the Overall Curriculum," ICME Proceedings, International Mathematics Union Secretariat, <https://www.mathunion.org/icmi/role-mathematics-overall-curriculum#:~:text=Mathematics%20provides%20an%20effective%20way.and%20even%20music%20and%20art>; Mike Lefkowitz; "Why is Math So Important?," Mind Research Institute. <https://blog.mindresearch.org/blog/why-is-math-so-important>.

⁶¹ "What is High Quality Math Instruction and Why is it Important?" Iris Center, Vanderbilt University, <https://iris.peabody.vanderbilt.edu/module/math/cresource/q1/p01/>.

⁶² "Better Math Skills Predict Bigger Bank Accounts," *Association for Psychological Science*, May 10th, 2016, <https://www.psychologicalscience.org/news/minds-business/better-math-skills-predict-bigger-bank-accounts.html#:~:text=Being%20good%20with%20numbers%20gives.lead%20to%20greater%20personal%20wealth>.

⁶³ International Mathematics Union Secretariat, "The Role of Mathematics in the Overall Curriculum."

Moreover, middle school math achievement influences students' high school outcomes. Students who leave middle school without a strong knowledge of fractions — a key prerequisite for algebra — begin high school as remedial math students.⁶⁴ During high school, students' math achievement is significantly predicted by students' middle school math outcomes.⁶⁵ Additionally, lower middle school math achievement is also correlated with lower high school graduation rates: in a sample of 13,000 sixth grade students in the School District of Philadelphia, 81% of students who failed a math course in sixth grade did not graduate from high school within five years.⁶⁶ These examples all demonstrate that fruitful efforts to address students' below-grade-level middle school math achievement can improve their high school academic outcomes.

An achievement-raising math intervention can also influence students' future employment opportunities and earning potential. According to the Bureau of Labor Statistics, employment in math occupations — which offer a median wage of \$53,000 more than the society-wide median wage — is expected to grow by 28 percent from 2020 to 2030, a jump of about 67,200 jobs.⁶⁷ If students possess a strong math foundation, they will increase their future chances of obtaining these math jobs and reaping the associated financial benefits. Math skills also influence employment in non-math fields. In a resume-based field experiment, Koedel and Tyhurst found that recruiters for sale positions are more responsive to high-education

⁶⁴ Jia Wang and Pete Goldschmidt, "The Importance of Middle School Mathematics on High School Students," *The Journal of Educational Research* 97, no. 1 (2003): 3-19; Tom Loveless, "Trends in Math Achievement: The Importance of Basic Skills," Brookings, <https://doi.org/10.1080/00220670309596624>.

⁶⁵ Jia Wang and Pete Goldschmidt, "The Importance of Middle School Mathematics on High School Students' Math Achievement."

⁶⁶ Robert Balfanz, Liza Herzog, and Douglas J. Mac Iver, "Preventing Student Disengagement and Keeping Students on the Graduation Path in Urban Middle-Grades Schools: Early Identification and Effective Interventions. *Educational Psychologist* 42, no. 4 (2007): 223-325, <https://doi.org/10.1080/00461520701621079>.

⁶⁷ "Math Occupations." Occupational Outlook Handbook, US Bureau of Labor Statistics, last modified April 18, 2022, <https://www.bls.gov/ooh/math/home.htm>.

resumes indicating stronger math skills, and stronger math skills had a positive but non-significant impact on employer interest in clerical resumes.⁶⁸ Students' future wellbeing depends on their employment and earning prospects, a factor which is partially determined by math skills.

Math learning gaps are often paired with detrimental mindsets about intelligence, while strong math skills are associated with a growth mindset. After obtaining low levels of achievement in math classes, individuals often view themselves as "math people" or "non-math people."⁶⁹ This conception of academic skills as an "in-born trait" is not only unique to math, but it also creates a mental barrier for students from disadvantaged backgrounds.⁷⁰ However, if students can raise their math skills, they can simultaneously cultivate a growth mindset. Kimball, Smith, and Quartz put it well: "If we can convince you that anyone can learn math, it should be a short step to convincing you that you can learn just about anything, if you work hard enough."⁷¹ This potential for a wholesale shift in students' conceptions of intelligence highlight the potential for an achievement-raising math program to have a significant impact for the students.

In sum, if Hamilton students develop stronger math skills, they can benefit from greater cognitive development, improved day-to-day results, stronger high school outcomes, more profitable labor market opportunities, and a shifted mindset about intelligence. If this problem is left unaddressed, Hamilton students will have lower chances gaining these same benefits.

⁶⁸ Cory Koedel and Eric Tyhurst, "Math Skills and Labor Market Outcomes: Evidence from a Resume-Based Field Experiment." *Economics of Education Review* 31, no. 1 (2012): 131-140; <https://doi.org/10.1016/j.econedurev.2011.09.006>.

⁶⁹ Miles Kimball, Noah Smith, and Quartz, "The Myth of 'I'm Bad at Math.'" *The Atlantic*, October 28th, 2013, <https://www.theatlantic.com/education/archive/2013/10/the-myth-of-im-bad-at-math/280914/>.

⁷⁰ Miles Kimball, Noah Smith, and Quartz, "The Myth of 'I'm Bad at Math.'"

⁷¹ Miles Kimball, Noah Smith, and Quartz, "The Myth of 'I'm Bad at Math.'"

Program-Specific Research

In the previous sections, I investigated the problem of race- and income-based middle school math achievement gaps by placing the problem in national, citywide, and local contexts. I also highlighted the crucial importance of addressing the below-grade-level math achievement of middle school students at Andrew Hamilton School.

A core component of this problem-solving learning paper is a detailed explanation of my proposed program, an expansion of the current afterschool math club at Andrew Hamilton school. In my proposed model, Penn undergraduate students will tutor students in the Hamilton afterschool math club. Before elaborating on the specific details of my program, it is important to share background research on similar programs, as this process will demonstrate the rationale behind several core features of Math and Munch.

Bridging Gaps and Building Capacity

One similar program is “Bridging Gaps and Building Capacity,” a 2021 summer enrichment program for students from five West Philadelphia schools: Penn Alexander, Lea, Comegys, Hamilton, and Mitchell.⁷² With additional funding support from a University of Pennsylvania Projects for Progress grant, the William Penn Foundation, and one additional donor, the Netter Center partnered with the Graduate School of Education to offer academic enrichment to about 200 elementary and middle school students at the Penn Alexander School in University City.⁷³ The six-week program aimed to prepare students for the transition back to the in-person classroom in the fall of 2021 after more than a year of online schooling.⁷⁴ The

⁷² Lauren Hertzler, “Meshing Academics and Fun for a Summer Program Like No Other,” *Penn Today*, October 4th, 2021, <https://penntoday.upenn.edu/news/penn-gse-netter-center-join-talents-inaugural-projects-progress-initiative>.

⁷³ Lauren Hertzler, “Meshing Academics and Fun for a Summer Program Like No Other.”

⁷⁴ Lauren Hertzler, “Meshing Academics and Fun for a Summer Program Like No Other.”

students attended academic classes taught by School District teachers from Monday through Thursday and participated in various Netter-led field trips on Fridays.⁷⁵ The program also partnered with many other programs or organizations, such as Penn Vet and Responsive Math Teaching.⁷⁶

According to Dr. Caroline Watts, Director of the Graduate School of Education's Office of Community and Civic Engagement, the program sought to steer clear of remedial education. She said, "Our goal was to provide something in person for the kids that would help grease their wheels to get ready to go back to school but would not be remedial, would not give the message of 'You have lost all this learning, you have to catch back up.'"⁷⁷ The program also focused on fun and engaging learning. Tonya Ware, an experienced teacher at the Lea school said, "I want it to be fun, because if they are bored, they aren't going to get anything from this. We do a lot of hands-on activities, and a lot of group work. Sometimes they don't even realize that it's math."⁷⁸

The program's emphasis on non-remedial learning was influential for me. I initially intended to focus the program on "fundamental skills," such as multiplication and division, but this program, along with feedback from Principal Rothmiller, helped me realize that a sole emphasis on basic elementary-level skills could negatively impact the students' mindsets about math. My current program also aims to steer clear of remedial learning and help the students learn grade level content.

⁷⁵ Lauren Hertzler, "Meshing Academics and Fun for a Summer Program Like No Other."

⁷⁶ Lauren Hertzler, "Meshing Academics and Fun for a Summer Program Like No Other."

⁷⁷ Lauren Hertzler, "Meshing Academics and Fun for a Summer Program Like No Other."

⁷⁸ Lauren Hertzler, "Meshing Academics and Fun for a Summer Program Like No Other."

The West Philadelphia Tutoring Project

I also researched the West Philadelphia Tutoring Project (WPTP). Based out of the University of Pennsylvania's Civic House, WPTP pairs Penn tutors with students from five Philadelphia public schools for a weekly 90-minute tutoring session.⁷⁹ The sessions normally occur at the Civic House, but they have been conducted over Zoom in the last two academic years due to the COVID-19 pandemic.⁸⁰ This year, at the beginning of the first session, the tutor met with their student's parent to identify specific areas of focus for the tutoring sessions.⁸¹ The WPTP tutors are also trained through multiple workshops. The beginning of the semester features the Large Tutor Orientation, which provides a broader overview of WPTP and the social context of West Philadelphia.⁸² The tutors then meet with a section leader in the Small Tutor Orientation to develop specific tutoring skills.⁸³ During the sessions, the tutors use a variety of resources from a WPTP resource bank to support their students' growth.⁸⁴ Paula Clark, a WPTP tutor, noted that she has seen significant improvement in her student's academic skills after several sessions.⁸⁵

These details about the West Philadelphia Tutoring Project were very helpful to the development of my program. I initially planned to only provide two training sessions about training skills, but after hearing about the Large Tutor Orientation, I realized that it was essential to incorporate a training session focused on West Philadelphia. Paula noted that a key weakness

⁷⁹ Paula Clark, "Interview with Om Manghani," interview by Om Manghani, April 3rd, 2022; Greg Johnson, "Tutoring Project Gives West Philly Students a Leg Up on Learning," *Penn Today*, October 22nd, 2015, <https://penntoday.upenn.edu/2015-10-22/features/tutoring-project-gives-west-philly-students-leg-learning>.

⁸⁰ Paula Clark, "Interview with Om Manghani."

⁸¹ Ibid.

⁸² Ibid.

⁸³ Ibid.

⁸⁴ Ibid.

⁸⁵ Ibid.

of the program is the tutors' lack of communication with their students' school.⁸⁶ This reflection reinforced the importance of maintaining a strong connection with the middle school math teachers at Hamilton.

Robeson Writes (Right2Write)

My program was also influenced by Right2Write (currently known as Robeson Writes), a program developed by Alisa Ghura, Hakiem Ellison, and Katey Givan through the Summer of 2020 PPPS internship program. The program offers a biweekly writing course at Paul Robeson School that aims to improve students' writing skills, explore different writing genres, and offer preparation for the Keystone Literature exam.⁸⁷

The development of Math and Munch was also influenced by Robeson Writes. At the beginning of each Robeson Writes session, students participate in a daily check-in, where "each student has an opportunity to share and reflect on their day."⁸⁸ I added a similar activity to the beginning of the tutoring sessions, as this would provide students with a valuable opportunity to reset before diving into more academic content.

⁸⁶ Paula Clark, "Interview with Om Manghani."

⁸⁷ Alisa Ghura, Hakiem Ellison, and Katey Givan, "Robeson's Right to Write," August 1st, 2020.

⁸⁸ Alisa Ghura, Hakiem Ellison, and Katey Givan, "Robeson's Right to Write."

A Tutoring Program in a Midwestern City

Math and Munch was also influenced by a tutoring program in a small midwestern city described by Hock, Pulvers, and Deshler in a journal article about effective afterschool tutoring programs.⁸⁹ Although the article was published in a journal about remedial education, it still provided a valuable insight related to my non-remedial tutoring program.

In their article, “The Effect of an After-School Tutoring Program on the Academic Performance of At-Risk Students and Students with LD,” the authors describe a 1-to-1 tutoring program for three at-risk junior high students who were failing two or more academic courses.⁹⁰ The after-school tutoring sessions were led by trained undergraduate tutors from a local university, who met with their assigned junior high student 2-3 times per week for about 30 minutes.⁹¹ The tutors guided the students through various assignments and helped them develop strategies to be used in similar math concepts in the future.⁹² The tutors were trained in a two-hour strategic tutoring workshop and received evaluations on an ongoing basis from the project research assistant.⁹³ As a whole, the strategic tutoring effectively raised the math achievement of the junior high grade students in the program.⁹⁴

If my memory serves me correctly, after reading about the research assistant’s efforts to evaluate the tutors on an ongoing basis, I became excited by the idea of asking the Math and Munch tutors to reflect on every tutoring session. This reflection would help tutors continuously improve their tutoring skills, a critical aspect of program success. I was also inspired to observe

⁸⁹ Michael Hock, Kim Pulvers, Donald Deshler, and Jean Schumaker, “The Effect of an After-School Tutoring Program on the Academic Performance of At-Risk Students and Students with LD,” *Remedial and Special Education* 22, no. 3 (2001): 172-186.

⁹⁰ Ibid.

⁹¹ Ibid.

⁹² Ibid.

⁹³ Ibid.

⁹⁴ Ibid.

the tutors in action, as this could help me conduct informed conversations with the tutors during our one-on-one check-ins. I plan on observing the tutors when I attend Math and Munch on a regular basis.

Andrew Hamilton's After-school Math Club

In the previous section, I described components of the research process associated with the development of Math and Munch. As noted in the title, my program seeks to expand the after-school math club at Andrew Hamilton School. Knowing this, it is important to also provide background on the math club before diving into the specific details of my program and its associated implementation.

Hamilton's after-school math club occurs in Ms. Blagrove's classroom from about 3:30 – 4:30 PM on Mondays and Tuesdays.⁹⁵ The program is open to middle school students, who can work on their homework with the support of mentors from Community School Student Partnerships (CSSP) — a student-led Netter Center program that connects undergraduate mentors with West Philadelphia schools — and Ms. Blagrove, the current 7th and 8th grade math teacher. After homework time, students can participate in other math-related activities, such as UNO, chess, and board games.⁹⁶ Most students that come to math club would benefit from 1-to-1 tutoring, as they possess below-grade-level math skills.⁹⁷

Hamilton's math club has also grappled with challenges related to student engagement. Although there are a significant number of students that sign up for math club, only a select number of students come to the club on a consistent basis.⁹⁸ Additionally, Nicholas Sathi, a CSSP mentor that supported math club on Mondays in the Spring of 2022, noted that not all the

⁹⁵ Jasmine Williams, Communication with the author; El Sada Blagrove, "Interview with Om Manghani," March 23rd, 2022.

⁹⁶ El Sada Blagrove, "Interview with Om Manghani," March 23rd, 2022.

⁹⁷ El Sada Blagrove, "Interview with Om Manghani," April 8th, 2022; Nicholas Sathi, "Interview with Om Manghani," April 5th, 2022.

⁹⁸ El Sada Blagrove, "Interview with Om Manghani," April 8th, 2022; Nicholas Sathi, "Interview with Om Manghani."

students have homework to work on and a 1-to-1 tutoring program would benefit the students.⁹⁹

More broadly, the effectiveness of both the West Philadelphia Tutoring Project and the tutoring program in the midwestern city — combined with the support of Ms. Blagrove and Nicholas — increased my confidence in the potential for a 1-to-1 tutoring program in the Hamilton after-school math club to benefit the Hamilton middle school students.

⁹⁹ Nicholas Sathi, “Interview with Om Manghani.”

Overview of Math and Munch (M&M)

The Daily Schedule

In the previous section, I detailed similar tutoring programs and their influences on the development of Math and Munch. In this section, I will provide a detailed overview of the daily schedule of the tutoring program.

In the Fall of 2022, on Mondays and Tuesdays after school, Penn undergraduate students will meet with Hamilton students to work on predetermined electronic math activities in 1-on-1 tutoring sessions. The tutors will meet their students in Ms. Blagrove's classroom at 3:30 PM, and the Hamilton student will receive a stamp on their punch card, an incentive system designed to encourage student attendance. Depending on the amount of space available, the Hamilton student and the undergraduate students will either work together in Ms. Blagrove's classroom or move to another empty classroom on the 3rd floor.

At the beginning of the session, the Hamilton student and Penn undergraduate will engage in casual conversation. Borrowed from Robeson Writes, this time provides an opportunity for bonding between the Penn undergraduate and the Hamilton student. The Hamilton student can also use the time to reset from their school day before diving into more academics.

From approximately 3:33 – 4:15 PM, the Penn undergraduate student will assist the Hamilton student as they complete electronic math activities assigned during a meeting between Ms. Jones, Ms. Blagrove, and me. The math activities will either be developed by the Penn undergraduate student, or they will be taken from three math websites used by Hamilton students and teachers: GeoGebra, Nearpod, or iReady. If the Hamilton student is 7th and 8th

grade, they will use a school Chromebook, as students have been able to access their Chromebooks during after-school programming in the 21-22 academic year.¹⁰⁰ If the 6th grade Hamilton students do not have access to a Chromebook, the tutor-tutee pair will use the tutor's laptop for the preassigned activities.

Throughout this main part of the tutoring session, the tutor will assist their student with the activities and provide ample opportunities for the Hamilton student to ask questions and share their thoughts. The tutors will steer clear of lecturing, ask guiding questions, and explain important math concepts as they arise. The tutor training — described in a few sections — will help to ensure that the tutors provide effective assistance to their Hamilton student.

After about 45 minutes, the students will take a break to work on any fun activity from the Julia Robinson Math Festival. Given that students are often tired after school, this will be a good time to relax and still engage in math content.¹⁰¹ The activities from the Julia Robinson Math Festival will be explained in the program curriculum section.

In the last 10 minutes of the session, the Hamilton student and Penn tutor will have the option to work on math homework, as Ms. Blagrove and Jazz both indicated the importance of still allowing for some time for students to work on their homework.¹⁰² If the student does not have math homework, the tutor and undergraduate student will continue to work on the preassigned activities. At the end of the session, the tutor and the Hamilton student will part ways, and the Hamilton student will proceed to other fun extracurricular activities offered in

¹⁰⁰ El Sada Blagrove, "Interview with Om Manghani," April 8th, 2022.

¹⁰¹ Wade Robinson, "Interview with Om Manghani."

¹⁰² El Sada Blagrove, "Interview with Om Manghani," April 8th, 2022; Jazz Williams, "Interview with Om Manghani," April 1st, 2022.

after-school programming. The Penn mentors will reflect on their session and document their progress by filling out the Google lesson plan, which will be shown below.

The following table presents a synthesis of the daily schedule:

Time	Item
3:00– 3:30 PM	Afterschool Snack Time at Hamilton
3:30 PM	Math and Munch begins! Punch cards are stamped by Ms. Blagrove or Penn student. Students and Hamilton mentors spend 2-3 minutes at the beginning of the session catching up and discussing topics unrelated to math.
3:33 – 4:15 PM	Hamilton students and Penn mentors work on skill building from preassigned activity.
4:15 – 4:20 PM [break]	Penn student and Hamilton student work on a fun activity from the Julia Robinson Math Festival.
4:20 – 4:30 PM	Hamilton student and Penn student work together on homework (if any). If students do not have homework, Hamilton student and Penn student keep working on skills from the individualized student plan.
4:30 PM	Students go to other fun afterschool activities.

A Comparison with Literature on Tutoring Programs

The education literature is filled with discussion of the characteristics of effective tutoring programs. As I created my program, I consulted the literature on effective tutoring programs and reflected on its alignment — or lack of alignment — with the characteristics of my program. Thus, before moving onto more details about Math and Munch, it is important to explain how the program aligns with and departs from widely held beliefs about effective tutoring.

The program agrees with several components of the literature on tutoring programs. The program's use of a shared document to track progress using grade-level standards agrees with Edward Gordon's description of the importance of tracking session-to-session progress.¹⁰³ As shown, Math and Munch mainly focuses on supplementary assignments rather than homework help, and this program characteristic that aligns with literature suggesting that higher homework completion rates are not necessarily associated with progress on standardized tests.¹⁰⁴ Poor attendance is also cited as a characteristic of ineffective tutoring programs, and as will be shown below, the program incorporates several attendance incentives.¹⁰⁵ Given that collaboration with the classroom teacher is cited as a vital characteristic for the success of a tutoring program, my collaborations with Ms. Jones and Ms. Blagrove could be very valuable.¹⁰⁶

¹⁰³ Edward Gordon, "5 Ways to Improve Tutoring Programs."

<https://journals.sagepub.com/doi/pdf/10.1177/003172170909000614>.

¹⁰⁴ Jennifer McCombs, Anamarie Whitaker, and Paul Yoo. "The Value of After School Time Programs," Rand, <https://www.wallacefoundation.org/knowledge-center/Documents/The-Value-of-Out-of-School-Time-Programs.pdf>.

¹⁰⁵ Terri Rothman and Mary Henderson, "Do School-Based Tutoring Programs Improve Student Performance On Standardized Tests?" *Online Research in Middle Level Education*, <https://files.eric.ed.gov/fulltext/EJ925246.pdf>.

¹⁰⁶ Terri Rothman and Mary Henderson, "Do School-Based Tutoring Programs Improve Student Performance On Standardized Tests?" *Online Research in Middle Level Education* 34, no. 6 (2011): <https://files.eric.ed.gov/fulltext/EJ925246.pdf>.

Finally, effective tutoring programs use data to track student progress, and I will be able to talk to Ms. Jones and Ms. Blagrove about STAR math testing scores.¹⁰⁷

That said, I made the conscious decision to deviate from several elements of effective tutoring programs. According to Education Trust, the most effective tutoring programs happen five days per week.¹⁰⁸ However, given the fact that the math club only happens two days per week and Paula's weekly WPTP sessions have led to academic growth, I decided to maintain the schedule of 2 days per week. The most effective tutoring programs also target the youngest ages.¹⁰⁹ I decided not to offer a program for elementary school students because I already had an established connection with Ms. Blagrove, the current 7th and 8th grade math teacher at Hamilton, and it would have been harder to build a new relationship with teachers in the lower grades. Additionally, while school-day and at-home tutoring is more effective than after-school tutoring, I knew that a school day or at-home program was not as implementable as a program that builds on established afterschool UACS programming.¹¹⁰

Finally, the literature emphasizes the importance of communicating with parents, as this process bolsters the academic growth associated with tutoring programs.¹¹¹ I have not yet included this element of the tutoring program, but this is a way that that Math and Munch could improve in the future.

¹⁰⁷ Kara Arundel, "5 Qualities of Effective In-School Tutoring Programs," *K-12 Dive*, April 23rd, 2021, <https://www.k12dive.com/news/7-critical-elements-to-make-tutoring-effective/598921/>.

¹⁰⁸ Education Trust and MRDC, "Targeted Intensive Tutoring," The Education Trust, <https://edtrust.org/resource/targeted-intensive-tutoring/>.

¹⁰⁹ Education Trust and MRDC, "Targeted Intensive Tutoring," The Education Trust, <https://edtrust.org/resource/targeted-intensive-tutoring/>.

¹¹⁰ Edward Gordon, "5 Ways to Improve Tutoring Programs."

¹¹¹ Edward Gordon, "5 Ways to Improve Tutoring Programs."

Program Curriculum

In the preceding section, I compared Math and Munch to the literature on effective math tutoring. In the following section, I will dive into the specific components of the program curriculum. I created this curriculum with help from Faustine Sun, El Sada Blagrove, and Joy Anderson Davis. Ms. Blagrove, Ms. Jones, and Jazz Williams have approved the specific sources of the math curriculum as well as the incorporation of growth mindset mini lessons. I chose to use iReady, Nearpod, and GeoGebra, as these online math platforms are used by Ms. Blagrove and can easily connect to the students' classroom standards or activities. The use of multiple familiar math platforms ensures that Ms. Blagrove and Ms. Jones will have a variety of options and can easily select suitable activities for every student. To the best of my knowledge, all the middle school students have used activities from at least one of these platforms, so it would not be challenging for the students to navigate these tasks.

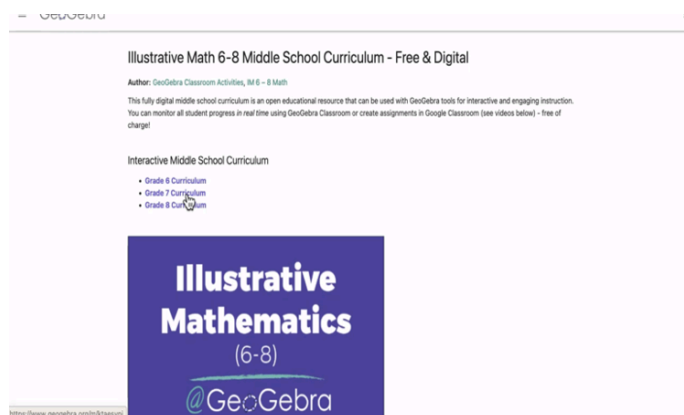
Math Curriculum

In the first four weeks of the program, the tutors and Hamilton students will work on activities from iReady, Nearpod, or GeoGebra on Mondays and Tuesdays. As I will describe in the implementation section, I will work with Ms. Jones and Ms. Blagrove to identify specific math activities from these three platforms. Since these three math platforms are used in Hamilton middle school math, it would not be hard for Ms. Blagrove or Ms. Jones to identify specific tasks for the students.

Like iReady and Nearpod, GeoGebra is an online math platform with effective activities. As shown in the picture below, the GeoGebra website provides access to a range of activities for

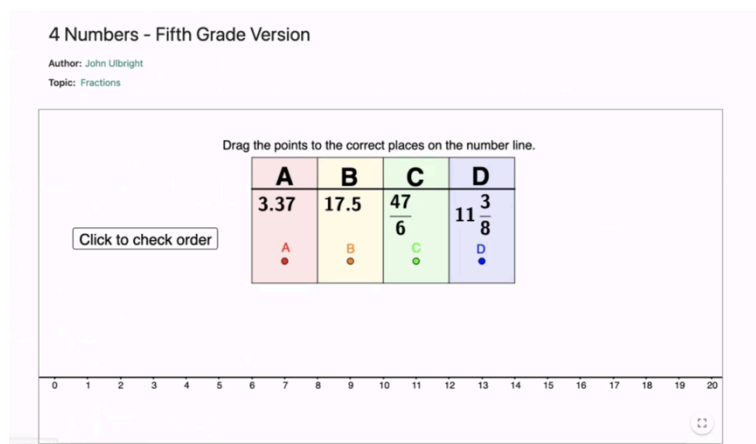
the students. Ms. Blagrove and Ms. Jones would be able to select an activity for any grade standard.

Figure 1: GeoGebra Math Platform¹¹²



The GeoGebra activities emphasize hands-on learning, rather than a lecture or direct instruction. The students will have the opportunity to interact with the virtual software and work on specific skills identified by their teachers. The following picture provides an example of a 5th grade activity with fractions:

Figure 2: Sample Geogebra Activity¹¹³

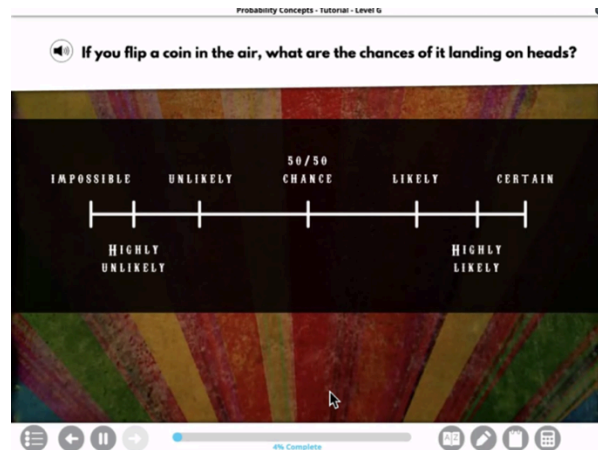


¹¹² El Sada Blagrove, "Interview with Om Manghani," April 8th, 2022.

¹¹³ El Sada Blagrove, "Interview with Om Manghani," April 8th, 2022.

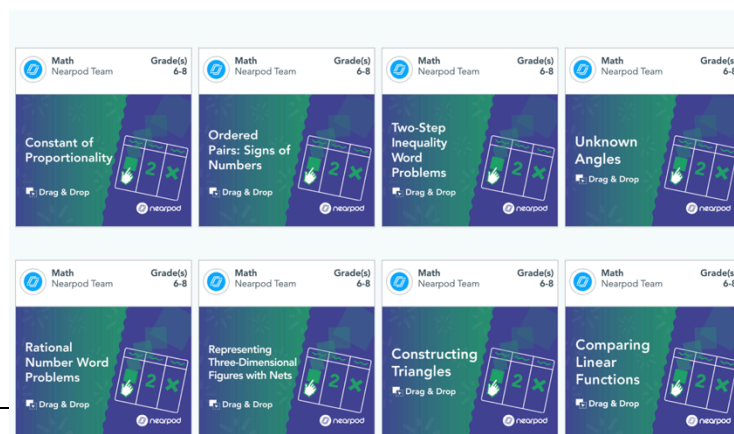
iReady is a similar platform. As shown in the picture below, the activities are engaging and could provide students with the opportunity to apply math concepts. In this lesson on probability, the student is asked to apply the concept of probability to a real-world setting, a task that would likely spark conversation between the Penn mentor and Hamilton student.

Figure 3: Sample iReady Activity¹¹⁴



Nearpod is an activity-based platform that also offers students the opportunity to work on math activities. As shown below, Nearpod offers a plethora of resources for many different standards:

Figure 4: Nearpod Activities¹¹⁵

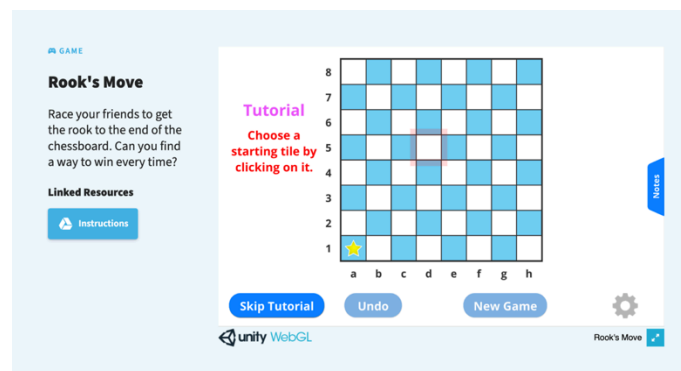


¹¹⁴ El Sada Blagrove, "Interview with Omi Manghani, April 8, 2022."

¹¹⁵ "Nearpod Library," Nearpod, <https://nearpod.com/t/7th-6th-8th-math-C377,389,386,261?t=100>.

As noted in the sample program schedule, the tutor and the Hamilton will also take a 5-minute break to work on any fun activity from the Julia Robinson Math Festival. The tasks still require critical thinking skills, but they allow the students to take a break from middle school math:

Figure 5: Activity from Julia Robinson Math Festival¹¹⁶



During the first four weeks of the program, the undergraduate student will gain a stronger understanding of their Hamilton student's math strengths and weaknesses by working on assigned activities from Nearpod, iReady, and GeoGebra. This stronger understanding will allow the undergraduate student to develop their own math activities at home for math sessions with their Hamilton student. Thus, from week 5 onwards, the tutor-student pairing will work on activities from GeoGebra, iReady, and Nearpod on Monday, followed by activities developed by the undergraduate tutor on Tuesday.

¹¹⁶ "Rook's Move," Julia Robinson Math Festival, <https://www.irmf.org/activities/rook-s-move>.

As the undergraduate tutors develop their own activities, they will likely increase their investment and dedication to Math and Munch. I will encourage the tutors to center the activities around the specific extracurricular interests of their student, as this would increase student engagement with the math and the afterschool program and ensure that the students do not feel bored with the previous three online platforms. For example, if one Hamilton student likes running and the tutor is focusing on ratios and proportional relationships, they could develop a task like the following.¹¹⁷

Figure 6: Running Path Activity (For Inspiration)



Running Path

Jose and Aadil were 10 miles apart and started running towards one another on a straight path. Jose ran at 10 mph, while Aadil ran at 8 mph. Will they meet in the middle of the 10 mile path? If so, explain how you know. If not, explain where they will meet.

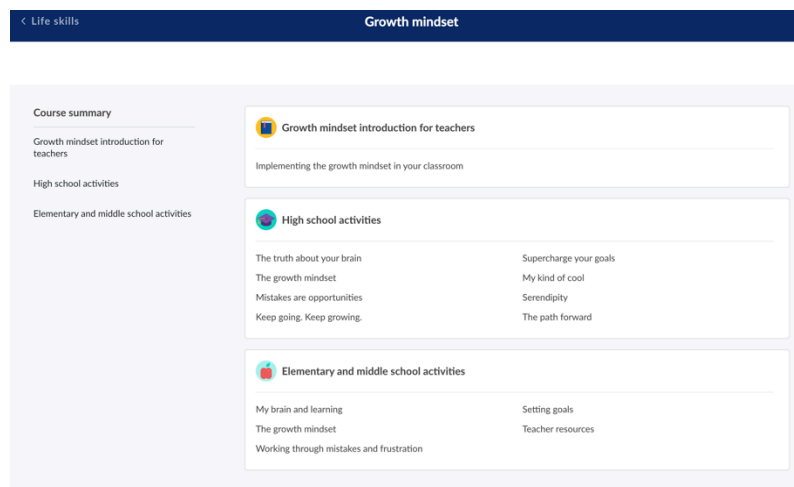
The task above comes from the Responsive Math Teaching's Task Bank, which also includes other middle school tasks that I will share with the undergraduate tutors for inspiration. I will work with the tutors to create similar activities that are grounded in engaging contexts and require students to think critically about the math concept. As I have learned through my time working with Responsive Math Teaching, "plug and chug" math activities do not stimulate as much learning as questions that have multiple answers or could be solved using multiple strategies. I have experience creating open-ended math tasks, and this experience will likely be helpful as I partner with tutors to create and workshop original math activities.

¹¹⁷ Responsive Math Teaching, "Running Path."

Growth Mindset Mini-Lessons

As referenced in my problem significance section, students with below-grade-level math skills often possess harmful mindsets about their intelligence. Additionally, research shows that middle school students with a growth mindset —a belief in their potential to improve with effort — reach higher levels of math performance.¹¹⁸ Thus, three times in the fall 2022 semester, students will spend 10 minutes at the beginning of the session working through a growth mindset mini-lesson from Khan Academy. These videos and readings have the potential to influence students’ learning mindsets and boost their achievement in math. The tutor will have the choice of any of the activities from the Khan Academy Growth Mindset module. I plan to share this site with Ms. Blagrove and Ms. Jones in our first meeting.

Figure 7: Growth Mindset Activities



¹¹⁸ Jo Boaler, Jack Dieckmann, Graciela Perez-Nunez, Kathy Liu Sun, and Cathy Williams, “Changing Students’ Minds and Achievement About Mathematics: The Impact of a Free Online Course.”

Individualized Student Plans

In the previous section, I explained the four major components of the math curriculum: tutor-created activities, Nearpod, iReady, and GeoGebra. To further elaborate on the Math and Munch curriculum, I will explain the specific categories of activities that the students could work on in their session with the tutor. These three categories were first created by Ms. Blagrove in our virtual meeting on April 8th.¹¹⁹

- 1) **Grade-Level Classroom Concept:** If a Hamilton student has been challenged by a specific classroom topic, they will work with their tutor to complete GeoGebra, iReady, Nearpod, or tutor-created activities related to this specific concept. For example, if a student is having trouble with probability, they would work on probability activities during their session. The program's targeted focus on classroom concepts will improve the Hamilton students' comprehension of grade-level concepts.
- 2) **Fundamental/Prerequisite Skill:** Some of the Hamilton students do not have a strong grasp on fundamental skills required to learn a middle school math concept, such as multiplication.¹²⁰ If Ms. Blagrove or Ms. Jones feels that a student would benefit from direct focus on one of these skills, the tutor-student pairing would work on iReady, Nearpod, GeoGebra, or tutor-created activities related to this area of focus.

As noted previously, it is important to both me and Principal Rothmiller that the tutoring program does not emphasize remedial education. For this reason, I will work to make sure that tutors and students only focus on these fundamental skills when they are required for classroom concepts. Although I have talked with Ms. Blagrove and Ms.

¹¹⁹ El Sada Blagrove, "Interview with Om Manghani," April 8th, 2022.

¹²⁰ El Sada Blagrove, "Interview with Om Manghani," March 23rd, 2022.

Jones about including several activities related to “fundamental skills” in the past, I will communicate this desired emphasis on non-remedial tutoring in our first meeting. This will ensure that any “fundamental skill” activities are closely connected to a grade-level concept.

- 3) **Introduction to Future Concepts:** Some Hamilton students would also benefit from exposure to an upcoming classroom concept.¹²¹ In this case, the tutor and student would work on activities that introduce upcoming topics. This process would ensure that students have the tools to tackle classroom concepts when they do arise.

I will synthesize each student’s activities and concepts of focus into an individualized student plan. The tutor will update this document after every tutoring session, and I will update the document after my initial conversation with Ms. Blagrove and Ms. Jones and after conversations with Ms. Blagrove and Ms. Jones during the semester. A sample individualized student plan is presented below.

¹²¹ El Sada Blagrove, “Interview with Om Manghani.”

Figure 8: Sample Individualized Student Plan

Om Manghani
PSL

Sample Individualized Student Plan

Overview Details

Student Name and Pronouns	
Grade and Teacher	
Current or Estimated Grade Equivalency (could reference STAR math testing)	
Student Personality/Characteristics	
Tutor Name, Class Year, Major, and Contact Information	

Math Details [Filled out by Om, Ms. Blagrove, and Ms. Jones]

#	Skill or Topic	Accompanying Common Core Standard	Specific Resources for Tutoring Session	Progress Based on STAR Testing/Teacher Evaluation
1				
2				
3				

Session Recaps [Filled out by Tutor]

#	Date and Time	Activities Completed	Description of Session/Comments	Mentor Reflection: What did I do well? What can I do better next time?
1				

2				
3				

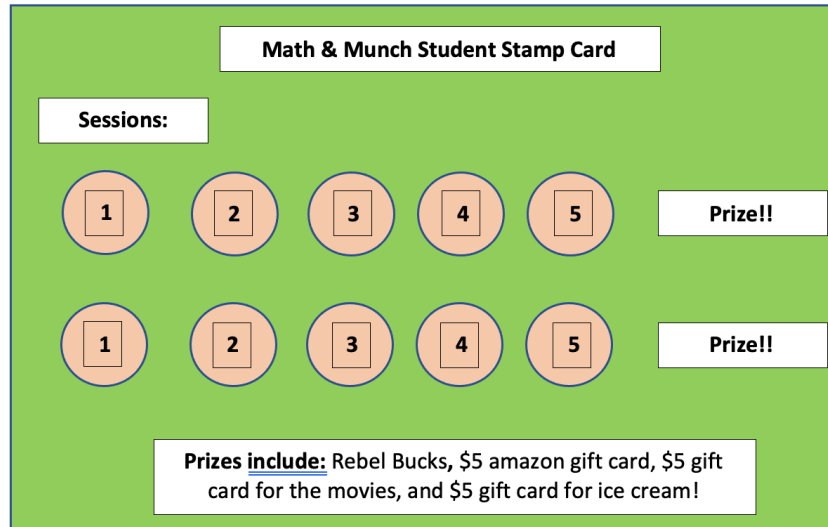
In the document, the “Session Recaps” section will directly flow from the “Math Details” section.” For example, if Ms. Blagrove or Ms. Jones recommend that activities for probability, I will add this standard and the associated activities to the “Math Details” table. The tutor will then refer to this “Math Details” table to plan and reflect on their tutoring session.

Hamilton Student Engagement

In the preceding section, I detailed the lesson plans. In this section, I will describe the four ways that I will encourage student engagement and attendance, a core component of Math and Munch.

1. **Snacks (the “Munch” in Math & Munch):** students will likely gain greater enjoyment from the program if they are offered an additional snack. As noted in the following agents and catalysts section, Regina Bynum has agreed to help me secure snacks.
2. **Stamp Card:** Students can also gain a prize if they attend 5 sessions. These prizes will include a \$5 amazon gift card, a \$5 gift card for ice cream, a \$5 gift card for the movies, and Rebel Bucks. Rebel Bucks can be used at the UACS Hamilton afterschool Fruit Stand. Jazz Williams has agreed to provide Rebel Bucks for the program, and Callista Dyer, my fellow CSSP co-director, has agreed to allocate \$50 from our CSSP budget for stamp card prizes. As previously noted, the students will receive a stamp on their card at the beginning of each session.

Figure 9: Math and Munch Stamp Card



3. **Individualized and Engaging Math Activities:** The three online math platforms used in the program — GeoGebra, Nearpod, and iReady — all include hands-on math activities that encourage the students to “learn by doing” and apply their knowledge. These activities will be more engaging than lecture-based sessions. Additionally, the tutor-created math activities will be centered around Hamilton students’ extracurricular interests. Hamilton students will likely feel more engaged in math if they can work on a personally relevant, open-ended problem.
4. **The First Session:** In the very first session, the tutor and student will not work on any math. Instead, the pair will get to know each other and discuss their mindset towards math. The session will begin with an introductory conversation, guided by questions inspired by and adopted from the Junior Jump Start Workbook:¹²²

Questions for Hamilton Student	Questions for Penn Student
What do you like about your school?	Where are you from?

¹²² Theresa Simmonds, Junior Jump Start Workbook.

• What would you change about your school? • Who are the most important people in your life? • What do you like to do in your spare time? • What is your favorite TV show/movie?	• What's your major (if you have one)? • What do you like to do in your free time? • What is your favorite part of college? What is your least favorite part of college?
---	--

After about 20 minutes of conversation, the tutor and student will discuss their personal orientations towards math. The pair will take turns answering the questions below. They will then use the answers and questions to engage in a deeper, free-flowing discussion about learning math.

Discussion Questions about Math

- What is enjoyable about math?
- What is challenging?
- How can a student improve their math skills?
- Why is math important?

This conversation provides an opportunity for both the tutor and the student to discuss previous areas of frustration or challenge in math. The broader framing and space for vulnerability will encourage the Hamilton student to trust their Penn tutor and feel comfortable openly discussing their feelings in the future. They will likely feel more engaged and attentive if they begin by thinking about the subject and the tutoring program with a broader lens. Moreover, the Penn tutor can encourage their student, explain the concept of a growth mindset, and express their confidence in the student's potential for future success.

At the end of the first session, the Penn tutor will briefly discuss logistical details, such as the stamp card and the plan to meeting on Mondays and Tuesdays after school.

Implementation: Agents, Catalysts, and Timeline

In the previous sections, I have provided a detailed description of the content of Math and Munch. In the following section, I will describe how this program will be implemented. The chart below details the agents, along with their specific roles.

Agents

Agents	Role and Timeline	Status
El Sada Blagrove (7 th and 8 th Grade Math Teacher at Andrew Hamilton) ¹²³	2nd week of September: Ms. Blagrove meets with Om and Ms. Jones to discuss areas of focus for students enrolled in the afterschool math club. Ms. Blagrove works with Om and Ms. Jones to find activities that would work well for each student from Nearpod, Illustrative Math, or iReady. We will meet over zoom or in-person, depending on what is most convenient for Ms. Jones and Ms. Blagrove. During Afterschool Math Club: Ms. Blagrove serves as the main supervisor for the afterschool math club. Biweekly throughout the semester: Ms. Blagrove meets with Om and Ms. Jones to discuss the progress of the students enrolled in the afterschool math club.	Confirmed. Ms. Blagrove has agreed to meet in the 1st or 2nd week of September. She has also agreed to meet biweekly throughout the semester. Ms. Blagrove is the primary math teacher involved in math club programming, so barring any staffing changes, she will remain as the main Hamilton supervisor for the program.
Tamara Jones (6 th Grade Math Teacher at Andrew Hamilton)	2nd week of September: Ms. Jones meets with Om and Ms. Blagrove to discuss the specific math gaps of the students enrolled in the afterschool math club. Ms. Jones works with Om and Ms. Blagrove to find activities that would work well for each student from Nearpod, Illustrative Math, or iReady. We will meet over zoom or in-person, depending on what is most convenient for Ms. Jones and Ms. Blagrove.	Confirmed. Ms. Jones has agreed to meet in the 1st or 2nd week of September. She has also agreed to meet biweekly throughout the semester to discuss student progress.

¹²³ I have not yet talked to Ms. Blagrove and Ms. Jones about my desire to steer clear of remedial tutoring. I will bring this up with the teachers at our first meeting.

	Biweekly throughout the semester: Ms. Jones meets with Om and Ms. Blagrove to discuss the progress of the students enrolled in the afterschool math club.	
Principal Torrence Rothmiller (Principal of Andrew Hamilton School)	Principal Rothmiller approves and supports the changes to the Hamilton Math Club.	Confirmed as of 4/20. In a meeting with me and Jazz Williams on April 20 th , Principal Rothmiller expressed his support for my description of Math and Munch. Due to timing constraints, I did not describe every detail of the program to Principal Rothmiller. Principal Rothmiller asked for a detailed description of Math and Munch, so I will send my PSL implementation section to him once it is complete. That said, Principal Rothmiller's support in our April 20 th indicates that he will continue to support the program.
Jazz Williams (Netter Center's Hamilton Site Director)	Jazz approves the changes to the Hamilton after-school math club and the math club's use of Rebel Bucks. Jazz also continues to offer the math club as part of UACS afterschool programming on Mondays and Tuesdays.	Confirmed. Jazz is on board with the daily schedule, the use of Rebel Bucks, the other incentives, the program curriculum, and the 1-to-1 tutoring. Jazz has also agreed to offer the math club on Mondays and Tuesdays in the fall. I have also told Jazz about the target start date for the 1-on-1 tutoring.

Joy Anderson Davis (Staff Member, Responsive Math Teaching)	2nd and 3rd Week of September: Joy conducts two mandatory hour-long training sessions for the tutors. These will occur at a convenient time for both Joy and the tutors.	Joy has agreed to lead two training sessions for about 15 Penn tutors. ¹²⁴
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Note: It is possible that the teachers who are teaching middle school math at Hamilton may change for the 22-23 academic year. In this instance, I meet with the new math teacher at the beginning of the school year, introduce Math and Munch, and ask if they would be willing to collaborate with me, Ms. Jones, and Ms. Blagrove.

Catalysts

Catalysts	Role and Timeline	Status
Om Manghani (UPenn '24)	I will serve as the student coordinator for the program. This role will entail spearheading marketing and recruitment for the program, observing the tutors, communicating with the tutors, and meeting with Ms. Blagrove and Ms. Jones to continually evaluate student progress.	Confirmed.
Faustine Sun (Assistant Director at the Netter Center)	Mid-August: Faustine allows me to add Math and Munch to the list of programs on the Netter Center recruitment document for the Fall 2022 semester. This will help me recruit undergraduate tutors.	Confirmed. Faustine agreed to this plan.
Sam Rosenberg (UPenn '22 and Current Co-President of UPenn Math Society)	End of August: Sam will distribute the marketing materials to the UPenn Math Society. As Sam will no longer be a student at Penn, he will contact a member of the math club to distribute the materials.	Confirmed. Sam has agreed to this plan.

¹²⁴ As a side note, Joy agreed to a training that would include an introduction to the Illustrative Math curriculum and tutoring skill building. Since this communication with Joy, I switched the curriculum to a combination of the four types of activities mentioned above, so training related to the Illustrative Math curriculum would not be as beneficial to the tutors. Joy's recent outline of the training session did not mention the Illustrative Math curriculum, so it appears that Joy will feel comfortable with a sole focus on tutoring skills, rather than a dual focus on curriculum navigation and tutoring skills. If Joy wishes to focus on the Illustrative Math curriculum as well, this Illustrative Math training could provide inspiration for the tutors as they develop their own activities.

Nikita Venugopal (CSSP Hamilton Site Coordinator and UPenn '24)	Week of Sept. 5th: Nikita will help me choose 3-4 CSSP Hamilton mentors to join the Math and Munch tutoring program.	Confirmed. Nikita has agreed the plan of assigning 3-4 mentors to math club.
Jazz Williams (Hamilton Site Director at the Netter Center)	April 2022: Jazz will help me connect to Principal Rothmiller to gain further support for the program.	Complete. Jazz has already connected me to Principal Rothmiller.
Julia Hawthorne (Sociology Department)	Fall 2022: Julia will help me publish the information in the Sociology Newsletter to attract students.	Confirmed. Julia has agreed to help me publish a blurb in the fall. I will contact Julia at the beginning of the fall semester to publish this blurb. If the newsletter is not active at the very beginning of the semester, I will ask Julia to publish the information on the Sociology Twitter page, which she has agreed to do.
Regina Bynum (Director of Teaching and Learning at the Netter Center)	Regina will help me source snacks for the program.	Confirmed. Regina agreed to help me obtain snacks for the program. In the event that this is no longer possible, I have also obtained permission from Callista Dyer to use extra CSSP funds for the snacks.
Callista Dyer (Fellow Co-Director, Community School Student Partnerships)	May 2022: Callista will agree to the use of \$50 of CSSP funds for program incentives.	Confirmed.

Fall 2022 Schedule

Math and Munch will also follow a schedule for the Fall of 2022 semester. In the beginning of August, I use various virtual platforms recruit undergraduate tutors for the program. The early start to the recruitment process will ensure that the undergraduate students can begin their security clearances as soon as the clearances office hours begin. I will interview the applicants shortly after they apply and accept tutors on a rolling basis to improve the chance that the tutors have enough time to complete their clearances before the target program start date. The application will close on September 5th, so all the tutors will be accepted to Math and Munch in time to attend the two training workshops with Joy Anderson Davis and an introduction workshop with me.

At the beginning of the academic year, Hamilton students sign up for UACS afterschool programing, including math club.¹²⁵ During the week of September 12th, I will meet with Ms. Blagrove and Ms. Jones — the middle school math teachers at Hamilton — to talk about the students who have signed up for math club. The three of us will discuss the students' specific math gaps and select activities from three sources — Geogebra, iReady, or Nearpod — for the tutors to use with the students. Barring any staffing changes, each student will be known by either Ms. Blagrove or Ms. Jones. If Ms. Blagrove does not have the list of students that have signed up for math club, I will contact Jazz Williams, Hamilton's UACS Site Director.

Jazz Williams was unsure of the math club fall 2022 start date, but Regina Bynum indicated that it would begin close to the beginning of the academic year.¹²⁶ Thus, shortly after

¹²⁵ Regina Bynum, "Interview with Om Manghani."

¹²⁶ Regina Bynum, "Interview with Om Manghani."

this initial planning meeting, I will contact Ms. Blagrove, the current teacher supervisor of Hamilton's afterschool math club, and ask her for a list of students who have come to the first math club meetings and would be able to come on both Mondays and Tuesdays. I will then use this list to pair Penn undergraduate students with math club attendees. While there is a potential for a greater number of pairings, I imagine that I will initially make 8-10 pairings between Penn students and Hamilton students and look to make more pairings later in the semester. There may be some new students that come to math club at various points in the semester, so I will work to quickly connect those students with a tutor. Since Ms. Jones, Ms. Blagrove, and would I have discussed all the students enrolled in the math club, it would not be hard to make additional pairings or individualized student plans to ensure that every attending student has a pairing.

Using notes from my initial meeting with Ms. Blagrove and Ms. Jones, I will then prepare an individualized plan for each student-tutor pairing. These pairings and the associated plans will be complete by about September 15th and 16th, in time for my introduction and training workshop with all the tutors. During this first meeting with the tutors, I will provide an overview of the program, answer questions, and provide each tutor with their student pairing.

In the 2nd and 3rd weeks of September, the tutors will attend 2 mandatory tutor trainings with Joy Anderson Davis. These meetings will be an opportunity for the students to gain a strong tutoring foundation before the target program start date on September 19th.

After the program launch, I will meet with Ms. Blagrove and Ms. Jones on a biweekly basis to discuss the progress of the students. Ms. Blagrove and Ms. Jones will receive STAR math testing data in October of 2021, and this will be very helpful in assessing the students' specific

skills. I will also take the time to ask the teachers about the students' engagement and performance in math class, their suggestions for specific ways that the program can be improved, and suggestions for activities to continue to use in the upcoming sessions.

The following table provides a summary of this semester schedule:

Approximate Date	Item
August 1st	Om begins to recruit Penn students virtually. Application for Math and Munch opens.
August 1 st – September 15 th	Om interviews Math and Munch applicants.
August 29 th	SDP First Day of School; UPenn First Day of School
Week of August 29 th	Om reaches out to Julia Hawthorne and Sam Rosenberg for support in advertising Math and Munch to undergraduate students.
Approx. First 2 Weeks of September	Hamilton students sign up for Math Club and begin attending, and Om supports undergraduate students navigate the clearances process.
Week of Sept. 5 th	Om works with Nikita, CSSP's Hamilton Site Coordinator, to select 3-4 returning CSSP mentors for Math and Munch.
September 5 th	Math and Munch application closes.
Week of Sept. 12 th	1 st Tutor Training Session with Joy Anderson Davis
Week of Sept. 12 th	Om meets with Ms. Blagrove and Ms. Jones to discuss list of signups for math club. Ms. Blagrove, Ms. Jones, and Om select activities for each student enrolled.
Thursday, September 15 th or Friday, September 16 th	Introduction and Training Workshop with Om Manghani [Zoom]
Week of Sept. 19 th	2 nd Tutor Training Session with Joy Anderson Davis
Monday, September 19 th	Target Program Start Date
Throughout the semester: Monday and Tuesday	Math and Munch Program in Hamilton's Afterschool Math Club
Throughout the semester: biweekly meetings	Ms. Jones, Ms. Blagrove and Om meet on a biweekly basis to discuss student progress.
Throughout the semester: weekly meetings	Penn students and Om will meet to discuss activities for the following week and any updates.
Week of October 10 th	From this date onwards, Penn undergraduate students begin to implement their own activities on Monday and implement activities from either iReady, Nearpod, or Geogebra on Tuesdays. 10-minute Growth mindset mini-lesson on Monday.
Week of November 7 th	Tutor Social Event; 10-minute Growth Mindset mini-lesson on Monday
Week of December 5 th	10-minute Growth Mindset mini-lesson on Monday

While I developed this timeline with my most up-to-date knowledge and expectations for the fall, it is important to caution that this timeline could change. For example, if tutors experience delays in the clearances process, we will likely begin the 1-on-1 tutoring at a slightly later date in September.

Tutor Recruitment

In the previous section, I provided an overview of the concrete details of implementation of Math and Munch. I will now build on this implementation strategy to discuss recruitment of Penn undergraduate tutors, central participants in my program.

Tutor Recruitment Overview

As noted in the previous section, 3-4 of the Penn undergraduate tutors will be members of Community School Student Partnerships (CSSP), a Netter Center program that connects Penn undergraduates with classrooms and afterschool programs at four West Philadelphia schools. I expect there will be about 8-10 initial student pairings (with a possibility of additional pairings later in the semester), so I plan to recruit about 8-10 undergraduate tutors. If there are more undergraduate tutors than Hamilton students, the remaining tutors will work with me to develop open-ended activities for current pairings or attend the math club as an additional tutor that could support as needed. I would aim to use this intermission time to quickly find another Hamilton student to be matched with the available tutors.

Recruitment Plan

To recruit the 8-10 undergraduate tutors, I will circulate a flyer and blurb within UPenn GroupMe chats and Facebook Groups. Sam Rosenberg will share the information with a member of the UPenn Math Society for wider distribution, and Julia Hawthorne from the Sociology Department will also help to share the information.

Figure 10: Math and Munch Flyer



As shown, the flyer links to a short application, which is shown below:

Figure 11: Tutor Application

Math and Munch: Tutor Application

Hello! Thank you for your interest in Math and Munch. As a tutor, you would be paired with a middle school student attending Andrew Hamilton School in West Philadelphia. During your sessions, you and the student would on predetermined electronic activities with the students to strengthen math skills and close learning gaps. Sessions will occur weekly on Monday and Tuesday from 3:30 - 4:30 PM.

manghani@ss.upenn.edu (not shared) [Switch account](#)

Name

Your answer

School and Major/s

Your answer

Why are you interested in tutoring with Math and Munch?

Your answer

Describe qualities of effective tutoring.

Your answer

Tutor Training

In the previous section, I furthered my explanation of the implementation plan by outlining the recruitment plan for the tutors. As previously noted, another key component of the program is the tutor training. The following section will elaborate on the two components of the tutor training: two skill-building workshops with Joy Anderson Davis and one introductory and overview workshop with me. In each of the subsections, I will also describe how the tutoring training aligns with research on effective tutoring.

“How to Help”: Training with Joy Anderson Davis

In an email, Joy provided the titles of five specific points that she is looking to cover in the two skill-building tutoring sessions at the beginning of the semester. These five concepts will be split over the course of two training sessions. Under each of the key concepts, I elaborate on the concept from my point of view and detail relevant research supporting the importance of covering this topic.

Key Concept 1: Determining the Learner’s Struggle or Stuck Point

Within every math topic, there one or two specific steps — or one or two specific mini-concepts — that create confusion for each student. Although the tutors will have background information about their individual student, it is important that they take the time to identify the exact point of confusion, as this will enable the tutor to help the student understand the concept in the most efficient manner. This first component of tutor training also aligns with the literature on effective tutoring. In “Tutors: Personal Qualities of Tutors,” Castek and colleagues describe how strong tutors were observant and attended to the learner’s

perception of their needs.¹²⁷ They also note that the effective tutors are responsive and help students identify what they do not know.¹²⁸ Although this research originates from a study of an adult tutoring program, the study design is more rigorous than several other resources about effective tutoring. Further, the fact that this concept was relevant for adults in turn means that it must be focused on in a tutoring program with younger middle school students.

Key Concept 2: Leading with Questions

The most insightful learning is a process of discovery. If the tutors ask a lot of questions, they allow students to discover the concepts on their own and eventually gain confidence in their ability to master the material. This thought aligns with Edward Gordon's assertion that master tutors should be "learning detectives, coaches, and mentors" rather than "homework helpers" or "test-prep specialists."¹²⁹

Key Concept 3: Engaging with Empathy (Don't Say It's Easy)

When students feel challenged by the math concepts, tutors should not adopt a condescending tone; instead, they should empathize with the student and understand their sources of frustration. Jana, an ex-tutor for the West Philadelphia Tutoring Project, asserted a similar idea when criticizing WPTP's training:

"Jana's biggest criticism of training was its failure to fully address the environment of Philadelphia public schools, how it might differ from tutors' educational backgrounds, and what kinds of stereotypical assumptions Penn students should be careful not to adopt. She felt that many tutors were not prepared to work with students who

¹²⁷ Jill Castek, Gloria Jacobs, and Kimberly Pendell, "Tutors: Personal Qualities of Tutors," *Tutor-Facilitated Digital Literacy Acquisition for Hard-to-Serve Populations: A Research Project*, https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1001&context=dla_research_briefs.

¹²⁸ Jill Castek, Gloria Jacobs, and Kimberly Pendell, "Tutors: Personal Qualities of Tutors."

¹²⁹ Edward Gordon, "5 Ways to Improve Tutoring Programs."

misbehaved or showed little interest in learning, and they were judgmental as a result.”¹³⁰

As Jana suggests, it is crucial for the tutors to recognize and dismantle their biases to establish the best relationships with the middle school scholars.

Key Concept 4: Making the Math Explicit

Clarity is essential. If tutors describe the math in a relevant and understandable manner, the students can quickly and smoothly absorb new concepts. This idea aligns with Caskey et. al’s emphasis on creativity, or “[developing] novel approaches to building relevance for new learners and teaching new concepts.”¹³¹ Tutors should leverage the various real-world applications of math to communicate their concepts explicitly.

Introductory Workshop with Om Manghani

At the beginning of the semester but after the two hour-long introductory training sessions with Joy Anderson Davis, I will host an hour-long introductory zoom workshop for the tutors. This workshop will have three goals: introduce the tutors to Math and Munch, provide a detailed overview of the West Philadelphia community, and share the individualized plans with the tutors.

I will begin by introducing the tutors to Math and Munch. I will cover the following points:

1. The below-grade-level math achievement of middle school students at Hamilton

¹³⁰ Chelsey Zhu, “When Tutoring Programs Fail,” *34th Street Magazine*, October 9th, 2014, <https://www.34st.com/article/2019/10/tutoring-programs-netter-center-philadelphia-public-schools-training-white-savior-pilots-transitory-disparity-inequality-students/>.

¹³¹ Jill Castek, Gloria Jacobs, and Kimberly Pendell, “Tutors: Personal Qualities of Tutors.”

2. Logistical details: when and where, clearances, laptops, taking SEPTA, and communicating with me via text
3. Reflections on tutor training sessions with Joy Anderson Davis
4. Questions about clearances (if any)

I will then proceed to provide an overview of the West Philadelphia community. This background is very important, as it will help students understand the social context of the community before engaging with their student. In an interview with 34th Street Magazine, Netter Center staff member Carter Gale noted that many Penn students approach service with a mentality of white saviorism.¹³² This presentation will work against white saviorism by providing a clear synthesis of pressing social issues, describing celebrated community leaders, recognizing the historically exploitative relationship between Penn and West Philadelphia, and emphasizing the importance of a mutually beneficial partnership. The presentation will be inspired by information in CSSP's first general body meeting presentations from the last three semesters. It will also be influenced by Theresa Simmonds' Spring 2022 presentation to URBS-178: "The School District of Philadelphia: An Overview."¹³³ The presentation will cover the following points:

- The History and Community of West Philadelphia; Overview of the Netter Center
- Celebrated Community Leaders and West Philly's Rich Culture
- West Philadelphia Demographics, Poverty, and Crime
- School District of Philadelphia Budget Shortfall and the Implications of Underfunded Urban Public Schools

¹³² Chelsey Zhu, "When Tutoring Programs Fail."

¹³³ Theresa Simmonds, "The School District of Philadelphia, An Overview."

- Penn and West Philadelphia's Complex and Historically Exploitative Relationship
- A Mutually Beneficial Partnership

In the last part of the session, the tutors will receive their individualized student plans. After explaining the importance of updating the individualized plans, I will then open the floor for the students to ask questions about their individualized student plan. I will also ask if any of the tutors have specific questions about the math that they will be teaching, as it is important that the tutors feel confident in their ability to explain all the concepts on the student plan.¹³⁴

I will then share the sample activities from Responsive Math Teaching and describe how the tutors will have the opportunity to implement their own open-ended activities for sessions with their students after the first four weeks. This time will hopefully encourage the tutors to start thinking about potential tutor-created activities to use on Tuesdays in week 5 onwards.

Friday Meetings

Each week, the tutors will meet with me for an hour on Friday over zoom. We will reflect on the tutoring sessions for the week and then split into breakout rooms to workshop the new activities for the upcoming week. The tutors will share their activities and offer feedback to each other. During this time, I will also individually check-in with all the tutors to ensure that their tutoring sessions are running smoothly.

Desired Outcomes and Program Evaluation

¹³⁴ Chelsea Zhu, "When Tutoring Programs Fail."

In the previous section, I provided an overview of the tutor training program. In this section, I will adopt a broader lens and consider the desired outcomes of Math and Munch for the Hamilton students, the Penn undergraduates, and Ms. Blagrove and Ms. Jones.

For Hamilton Students

Through Math and Munch, I hope that the Hamilton students will increase their enjoyment of math and make progress in their comprehension of grade-level concepts. As noted in the problem significance section, stronger math skills will benefit the students in myriad ways. It is currently hard to set a specific goal for improvement, as I am not sure what level of improvement is feasible, but my current goal is that all the students involved in Math and Munch will improve relative to grade-level benchmarks over the course of their time in Math and Munch.

If Hamilton students develop stronger math skills, they will obtain higher scores on STAR math test scores, feel more confident in their math abilities, and perform at a higher level in class. In my meetings with Ms. Jones and Ms. Blagrove, I will ask the teachers about the progress of the students. The students take internal STAR math tests on a regular basis, so the teachers will be able to consult these results as well. I will document these updates from the biweekly meetings on the lesson plans document.

Five weeks into the program and again at the end of the program, the Penn tutors will work with the Hamilton students to fill out a small set of questions at the completion of a tutoring session. These questions will help me evaluate whether the Hamilton students possess stronger math skills and enjoy math more:

- What was your favorite part of tutoring sessions with your Penn mentor?
- What did you learn during this time?

- How could these sessions be improved?

For Ms. Blagrove and Ms. Jones

As noted in the problem background, Hamilton's math curriculum — combined with several powerful factors — prevent Ms. Blagrove and Ms. Jones from helping the students systematically reach grade level standards. However, if middle school students are refining their math skills through Math and Munch, there is a greater chance that students will be able to learn at grade level in the classroom. Thus, I hope that Ms. Blagrove and Ms. Jones will find it easier to teach grade-level concepts. I also hope that Ms. Blagrove and Ms. Jones find that their students are more engaged in the classroom.

I will evaluate these two desired outcomes through conversations with the teachers. Specifically, mid-way through the semester and at the end of the semester, I will ask them the following questions in our biweekly check-in. These questions will also likely come up during other biweekly check-ins.

1. Do you see any substantial shift in your classroom that you could attribute to Math and Munch?
2. How would you describe Math and Munch's impact on the students?

For Penn Tutors

I hope that the Penn students will achieve three outcomes. First, I want the Penn students to walk away from the program with greater knowledge of specific tutoring techniques. Through the training with Joy, personal reflection, and communication with me, I hope that each tutor will develop a greater capacity to support the mathematical growth of a middle school student. Second, I hope that the Penn tutors will form a strong bond with their

Hamilton student. I have developed bonds with students in tutoring or teaching programs before, and I know that these relationships can be both meaningful and significant. The excitement and passion of the Hamilton students has already positively impacted my life, I know that relationships with the Hamilton students can also benefit the Penn tutors. Third and finally, I hope the Penn students will develop a continued interest in this program and civic engagement more broadly.

I will assess these program goals in a Google Form that I send to the mentors at the halfway point at the end of the semester and again at the end of the semester:

Figure 10: Form Used for Student Program Evaluation

Math and Munch: Program Reflection

Hi Team! Fill out the following form below to give me a sense of your experiences tutoring with Math and Munch!

manghani@sas.upenn.edu (not shared) [Switch account](#)

What specific tutoring skills have you learned through the Math and Munch program? Provide two examples.

Your answer

How has your relationship with your Hamilton student evolved and changed? Describe a memorable moment. How would you rate your current relationship with your Hamilton student?

Your answer

On a scale of 1-5, how important is math and munch to your experience in college and at Penn?

1 2 3 4 5

Not important at all ☐ ☐ ☐ ☐ ☐ Very important

How has Math and Munch changed or shifted your mindset around civic engagement more broadly? If it has not caused a substantial mindset shift, you can indicate that as well.

Your answer

Program Sustainability

In the previous section, I described my desired program outcomes and associated methods of evaluation. Before describing the next steps for implementation and research, I will focus on program sustainability.

On the student coordinator front, I will be a student at Penn for at least two more years, so I will be able to continue to develop and cultivate Math and Munch. In my senior year, I will select one of the tutors for the student coordinator position. I will spend a significant amount of time training this individual to ensure that they understand all aspects of Math and Munch. While I will spearhead the marketing and recruitment for the program in the Fall of 2022, I will recruit a marketing coordinator by the end of the fall semester, and this individual will spearhead recruitment in 2023. After I leave Penn, I will be sure to check-in on the program to provide advice and encouragement.

A key part of sustainability is tutor retention: if tutors continue to tutor with Math and Munch for multiple years, the program will be sustained over a longer period. To encourage tutor retention, I will host a tutor social event on College Green during the Week of November 7th, where the tutors can deepen their connection to one another and the Math and Munch program. Additionally, I hope that the tutors will feel more invested and connected to Math and Munch when they create and implement their own activities. Finally, I will create a group chat, as will promote community among the tutors.

Ms. Blagrove and Ms. Jones represent key components of this program. If Ms. Blagrove or Ms. Jones stop teaching at Hamilton, I plan to reach out to the incoming middle school math teacher and involve them in the Math and Munch process. It is also possible that Joy would not

be able to conduct a training session in the future. In this instance, I would plan to reach out to another member of the Responsive Math Teaching Team and ask for their support with tutor training.

Next Steps for Implementation and Research

In the previous sections, I have attempted to provide a detailed explanation of the problem of below-grade-level middle school math achievement and the Math and Munch program. In the penultimate body section, I will outline the required next steps for implementation and research.

Next Steps for Implementation:

1. Principal Rothmiller has asked for a final writeup of the program structure. Upon submission of this PSL, I will send the relevant sections to Principal Rothmiller.
2. Over the summer, I will work with Joy to continue to flesh out the training sessions. I will also finalize the two training dates with Joy for the fall.
3. On August 1st, I will begin to follow the Fall 2022 implementation schedule and begin recruitment.

Next Steps for Research:

1. If I were to continue researching, I would connect with Prof. Mona Merling, instructor for MATH-123. I was unable to connect with Dr. Merling during the semester, but her ABCS class is very similar to Math and Munch.
- 4.

From Here to There

In the previous sections, I have described the problem of math learning gaps at Andrew Hamilton School and outlined a detailed plan for an associated intervention. In the following section, I will describe my process of getting from “here to there.” This learning process was filled with twists and turns. In total, I conducted about 18 interviews or phone calls, which significantly helped the process of the program development.

Step 1: Initial Interview with Ms. Blagrove: A Focus on Curriculum

My PSL process began with a meeting with Ms. El Sada Blagrove, the 7th and 8th grade math teacher at Andrew Hamilton School. During our meeting, I asked Ms. Blagrove about the impact of the pandemic on the math skills of Hamilton middle school students. Ms. Blagrove helped me understand that the pandemic may have highlighted and exacerbated the students’ below-grade-level skills, but the challenge already existed before the pandemic.¹³⁵ She primarily discussed issues with the curriculum: she said that the curriculum was hard to follow and did not adequately address the students’ academic needs.¹³⁶ After hearing this, I made the connection to Responsive Math Teaching, an initiative through the UPenn Graduate School of Education that specifically focuses on providing professional development to teachers and creating open-facing math curricula. In my PSL framework due on February 28th, I wrote:

“RMT could collaborate with middle school math teachers and the principal of an SDP school (possibly Andrew Hamilton) to adjust the math curriculum to suit the variety of learning levels within the middle school student population. Responsive Math Teaching could help ensure that the classroom exercises contain a “lower floor” that gives teachers the opportunity to address previous gaps in knowledge.”¹³⁷

¹³⁵ El Sada Blagrove, “Interview with Om Manghani,” February 23rd, 2022.

¹³⁶ El Sada Blagrove, “Interview with Om Manghani.”

¹³⁷ Om Manghani, PSL Framework, February 28th.

Step 2: Meeting with Prof. Harkavy, Prof. Simmonds, Regina, and Latifah: Involving Penn Students and the Lunchtime “Power Hour”

In a seminar meeting shortly after this initial conversation, Prof. Simmonds provided me with the valuable advice: proposing curriculum adjustment sessions would be infeasible and not implementable. I knew that implementation was a big part of the PSL, so I decided to scrap this idea. Prof. Harkavy then encouraged me to involve Penn students and leverage my connections with CSSP and the Netter Center Student Advisory Board. I also thought about integrating Moelis Access Science into the program.

Regina Bynum was also very influential in this stage of the process. In a conversation over spring break, Regina floated the idea of adding a “power hour” during lunchtime that would address below-grade-level math achievement.¹³⁸ She talked about how the “power hour” could offer fun activities to increase student engagement.¹³⁹

With these two meetings in mind, in my PSL framework due on March 14th, I wrote:

“With the support of CSSP and MAS leadership, CSSP mentors and MAS fellows could lead a lunchtime program (a “power hour”) designed to help students build important math skills related to current classroom content. In these sessions, students can eat lunch and participate in a fun math activity that enables them to collaborate with their classmates and address gaps in their math knowledge.”¹⁴⁰

Step 3: Meeting with Ms. Jones, Mr. Robinson, and Latifah Anderson.

¹³⁸ Regina Bynum, “Interview with Om Manghani,” March 11th, 2022.

¹³⁹ Regina Bynum, “Interview with Om Manghani.”

¹⁴⁰ Om Manghani, PSL Framework, March 14th.

I then met with Latifah Anderson, who told me about the importance of making 1-to-1 pairings between Penn undergraduates and Hamilton students.¹⁴¹ She also encouraged me to involve a member of Responsive Math Teaching to assist with the program.¹⁴²

A few days later, I met with Mr. Robinson, a 5th grade math teacher at Hamilton and the math instructional lead. He told me that the lunchtime slot would be challenging, so I decided to move my program to after school.¹⁴³ I also met with the 6th grade math teacher, Ms. Jones, who appreciated the idea of the afterschool program.¹⁴⁴ These meetings with Ms. Jones and Mr. Robinson also helped me gain a more concrete understanding of the problem of math learning gaps at Hamilton.

Then, for my PSL framework due on March 21st, I wrote:

“With the support of CSSP and MAS leadership, CSSP mentors and MAS fellows could partake in a 1-on-1 after-school math program designed to help Hamilton students build important math skills related to current classroom content. In these sessions, Hamilton students can engage with a Penn student and participate in a fun math activity that addresses gaps in their personal math knowledge.”¹⁴⁵

Step 4: Continued Meetings with Ms. Blagrove and Ms. Jones: Expanding the After-school Math Club

Through my involvement with CSSP, I knew that the Hamilton after-school program featured a math club. Given that my program was going to happen during after-school programming, I knew that there was potential to combine my efforts with the current math club.

¹⁴¹ Latifah Anderson, “Interview with Om Manghani,” March 5th, 2022.

¹⁴² Latifah Anderson, “Interview with Om Manghani.”

¹⁴³ Wade Robinson, “Interview with Om Manghani.”

¹⁴⁴ Tamara Jones, “Interview with Om Manghani.”

¹⁴⁵ Om Manghani, PSL Framework, March 21st, 2022.

I proceeded to contact Ms. Blagrove, who told me about the current math club. Ms. Blagrove agreed to the idea of expanding math club so that students can focus on “fundamental skills” that will support their growth as math learners.¹⁴⁶

I knew that I would have to develop a strong curriculum for the program, so I turned to Joy Anderson Davis, who works for Responsive Math Teaching. Joy not only suggested the Illustrative Math curriculum and the Julia Robinson Math Festival, but she also told me about the importance of focusing on students’ math mindsets during the first session.¹⁴⁷ Joy’s powerful suggestion inspired the first session of Math and Munch as described in the “Student Engagement” session.

Then, for my PSL framework due on March 21stth, I wrote:

“With the support of CSSP leadership and Ms. Blagrove (current teacher supervisor of the math club), CSSP mentors (along with other Penn students) could support the expansion of the Hamilton after-school math club, a program that currently provides students the opportunity to work their homework and play games such as chess and “Uno” after school.”

Step 5: Further Research and Logistical Planning

I knew the next step in the process was to return to the key agents in my program — Ms. Blagrove and Ms. Jones — to ask them about the new idea for the expansion of the math club and hear their specific thoughts. In interviews on April 4th and 8th, I talked to the teachers about their potential responsibilities as agents. Ms. Jones was receptive to the proposed plan.

Ms. Blagrove was also very receptive to the new plan, and she also offered suggestions about a new curriculum to use.¹⁴⁸ I entered the conversation looking to use the Illustrative Math curriculum, but Ms. Blagrove helped me realize that the Illustrative Math curriculum would not

¹⁴⁶ El Sada Blagrove, “Interview with Om Manghani,” March 23rd, 2022.

¹⁴⁷ Joy Anderson Davis, “Interview with Om Manghani,” March 25th, 2022.

¹⁴⁸ El Sada Blagrove, “Interview with Om Manghani,” April 8th, 2022.

fit well with the curricular infrastructure of the Hamilton math classroom. Thus, during the call, we decided to switch the program to specifically focus on three sources of activities: Nearpod, iReady, and Geogebra. Ms. Blagrove gave me a virtual tour of the three resources and provided a template for the types of activities that the students could work on during the tutoring session.

On April 5th, I interviewed Nicholas Sathi — a CSSP mentor that supported the math club on Mondays in the Fall of 2022 — to learn more about the current club. Nicholas told me that the students would benefit from the new tutoring, which increased my confidence in the proposed program.

On April 1st, I met with Jazz during a CSSP-related visit to Hamilton. In this conversation, Jazz indicated his support for 1-to-1 tutoring in Hamilton’s after-school math club.¹⁴⁹ At the end of our conversation, Jazz told me that he would speak to Principal Rothmiller about the idea. On April 7th, I had another follow-up conversation with Jazz, who told me that Principal Rothmiller wanted the math club to be centered around tutoring, rather than remedial education.¹⁵⁰ I had not thought about this difference before, so I then consulted the article about the Netter-GSE Summer 2021 program. Throughout the rest of the PSL process, I tried to ensure that the tutoring program was not remedial and instead helped Hamilton students learn grade-level content. As noted in the program curriculum section, when the tutors focus on below-grade-level skills, it would be for the sole purpose of eventually working on grade-level material.

¹⁴⁹ Jazz Williams, “Interview with Om Manghani,” April 1st, 2022.

¹⁵⁰ Jazz Williams, “Interview with Om Manghani,” April 7th, 2022.

In this stage, I was almost finished with the expansion of the after-school math club. I met with Faustine Sun, assistant director of the Netter Center, to talk about recruitment for the program. Faustine told me that I could add the math club to the Netter Center's list of signups for students in the fall of 2022.¹⁵¹ In our PSL feedback session, Faustine encouraged me to include tutor-created activities that are related to students' extracurricular interests. I liked this idea, so I included these tutor-created activities as an element of my program curriculum.

Step 5: Talking with Principal Rothmiller

With the program almost solidified, I knew that there was one piece of the puzzle missing: Principal Rothmiller's approval. After the School District's Spring Break, I met with Principal Rothmiller to describe my program to him. He expressed his support for my description and asked that I send the final outline to him.¹⁵²

Step 6: Final Logistical Details

In the following weeks, I remained in touch with Ms. Jones, Ms. Blagrove, and Jazz to hash out some final logistical details. This led me to my final PSL.

¹⁵¹ Faustine Sun, "Interview with Om Manghani," April 7th, 2022.

¹⁵² Torrence Rothmiller, "Meeting with Om Manghani, Jazz Williams, and Regina Bynum," April 20th, 2022.

Personal Reflection

Note: this reflection was updated since the original due date of April 27th.

I feel more efficacious thanks to this seminar. Through the PSL process, I have become more confident in my ability to partner with community members and tangibly contribute to solving a social problem. The seminar has taught me that when Penn students dedicate themselves to the PSL process, integrate a variety of resources, work with others, seek feedback, and center the voices of community members, they can help advance a larger push for equity and justice. My increased sense of efficaciousness stems from my interactions with the wonderful staff at Hamilton. A few weeks ago, in response to one of my text messages, Jazz wrote, "Let's do something great!" I would not feel as efficacious if I did not receive such awesome support from partners at Hamilton and Netter such as Jazz, Ms. Blagrove, and Regina. These individuals have not only supported the development of my PSL, but they have also helped me realize that our program can extend beyond a written proposal and become part of after-school programming at Hamilton. Before the seminar, I knew that I wanted to help address a strategic social problem, but I felt a bit removed from the process of doing so. It has been empowering to learn about this journey of moving from "here to there" and transforming altruistic desires into specific action steps.

The seminar has both increased and decreased my level of optimism. On one hand, as I learned about the scale and magnitude of social challenges in West Philadelphia, I realized the tremendous effort required to substantially alleviate problems such as poverty and food insecurity. For example, I did not realize that it will require close to \$5B to fully alleviate the physical challenges facing Philadelphia schools. On the other hand, however, I have also learned

about the impressive skills and knowledge of my classmates and students involved with Netter programming. Their dedication to a more equitable future — coupled with their strong capacity to realize this goal — fills me with hope.

Over the course of the seminar, I have developed five goals, the fifth of which I added in my midterm reflection. These goals were: (1) learn how to create an equity-focused initiative grounded in the perspectives of community partners, (2) build the foundation for the implementation of my initiative in fall 2022, (3) build connections with my peers and the teaching team, (4) refine my knowledge of effective community engagement, and (5) write a rich and detailed PSL that offers wide-ranging research and a clear plan for implementation. Since the midterm reflection, my goals have not changed, as these goals represent a well-rounded synthesis of my intentions in this seminar.

I feel that I have accomplished goal (1). Reading past PSLs has been an inspiring and eye-opening experience: I now know that a strong program requires hard work, patience, thoughtful planning, attention to detail, and a willingness to pivot or shift gears. Through my own PSL process, I have learned that clear and frequent communication with community partners ensures that they are a true partner in the process. I have also learned that it is valuable to gain the perspectives of individuals who may not be an agent or a catalyst in the proposed program but possess experience working in the relevant field or context.

I have not yet accomplished goals (2) and (5), as my PSL has not been completely evaluated. That said, several pieces appear to be in place.

The recent seminar classes have indicated to me that I have built strong connections with my peers and the teaching team and accomplished goal (3). It has been fun to crack jokes

with Ashmit and Jeffrey, and it was nice to say “hi” to one of my classmates in the dining hall. I also feel well connected to Tomi and Profs. Harkavy and Simmonds: they have not only provided invaluable support to my PSL process, but they have also shared their rich personal experiences with us. I also feel very comfortable asking my peers and teachers for feedback about my ideas.

I believe that I have “refined my knowledge of effective community engagement” (goal #4). I have a deeper understanding of the role universities can and should play in building mutually beneficial partnerships with the local community and advancing social change. I also have learned about the importance of integrating a variety of resources within the local community, transforming the school into a “social center,” and remaining faithful to democratic ideals. However, there is so much left to learn. I want to spend more grappling with these concepts, as this thinking will improve the effectiveness of my community engagement in the future.

In sum, this has been one of my favorite classes thus far in my Penn experience. I am very grateful for this opportunity to “learn by doing.”

Other PSLs Referenced

In the process of writing my PSL, I referenced other PSLs. I did not take any specific ideas or sources from these PSLs without citation, but these essays influenced my PSL development and structure.

- Alisa Ghura, Hakiem Ellison, and Katey Givan: Robeson's Right to Write. Summer 2020.
- Jessica Ford: Robeson Youth Society of Engineers. Summer 2021.
- Anneka Ignatius: The Copeland Dance Program. Spring 2020.
- Steven Wren: Changing the Way Penn Presents Community Engagement to Prospective Students Through the Lens of Admissions Programming. Summer 2021.
- Mya Gordon and Nyah Williams. Addressing Low Academic Performance Through Culturally Relevant Mentorship. Summer 2021.
- Chandani Battle, Wilder Bravo, Jadah Daley, Cory Parker, and Tiara Risby. Expanding the Approach to Post-Secondary Planning. Fall 2018. Link [here](#).

Bibliography

- Association for Psychological Science. "Better Math Skills Predict Bigger Bank Accounts." May 10th, 2016.
<https://www.psychologicalscience.org/news/minds-business/better-math-skills-predict-bigger-bank-accounts.html#:~:text=Being%20good%20with%20numbers%20gives,lead%20to%20greater%20personal%20wealth.>
- Balfanz, Robert, Liza Herzog, and Douglas J. Mac Iver. "Preventing Student Disengagement and Keeping Students on the Graduation Path in Urban Middle-Grades Schools: Early Identification and Effective Interventions." *Educational Psychologist* 42, no. 4 (2007): 223-325. <https://doi.org/10.1080/00461520701621079>.
- Barshay, Jill. "Inside the Reardon-Hanushek Clash Over 50 Years of Achievement Gaps," *Hechinger Report*, May 27th, 2019.
<https://hechingerreport.org/inside-the-reardon-hanushek-clash-over-50-years-of-achievement-gaps/>.
- Blagrove, El Sada. "Interview with Om Manghani." Interview by Om Manghani. February 23rd, 2022.
- Blagrove, El Sada. "Interview with Om Manghani." Interview by Om Manghani. March 23rd, 2022.
- Blagrove, El Sada. "Interview with Om Manghani." Interview by Om Manghani. March 23rd, 2022.
- Boaler, Jo, Jack Dieckmann, Graciela Perez-Nunez, Kathy Liu Sun, and Cathy Williams. "Changing Students' Minds and Achievement About Mathematics: The Impact of a Free Online Course." *Frontiers in Education* (2018): 26, <https://doi.org/10.3389/feduc.2018.00026>.
- Bynum, Regina. "Interview with Om Manghani." Interview by Om Manghani. April 8th, 2022.
- Carnoy, Martin and Emma Garcia, "Five Key Trends in US Student Performance." *Economic Policy Institute*, January 12th, 2017.
<https://www.epi.org/publication/five-key-trends-in-u-s-student-performance-progress-by-blacks-and-hispanics-the-takeoff-of-asians-the-stall-of-non-english-speakers-the-persistence-of-socioeconomic-gaps-and-the-damaging-effect/>.
- Castek, Jill, Gloria Jacobs, and Kimberly Pendel. "Tutors: Personal Qualities of Tutors," *Tutor-Facilitated Digital Literacy Acquisition for Hard-to-Serve Populations: A Research Project*.

https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?article=1001&context=dla_research_briefs.

Corwin. "Common Causes of Achievement Gaps." PD Services,
<https://us.corwin.com/en-us/nam/equity-causes-of-achievement-gaps>.

Chingos, Matthew M. and Grover J. "Russ" Whitehurst. "Class Size: What Research Says and What it Means for State Policy." *Brookings*, May 11th, 2021.
<https://www.brookings.edu/research/class-size-what-research-says-and-what-it-means-for-state-policy/>.

Clark, Paula. "Interview with Om Manghani." Interview by Om Manghani. April 3rd, 2022.

Dorn, Emma, Bryan Hancock, Jimmy Sarakatsannis, and Ellen Viruleg. "COVID-19 and Learning Loss — Disparities Grow and Students Need Help." *McKinsey*, December 8th, 2021.
<https://www.mckinsey.com/industries/public-and-social-sector/our-insights/covid-19-and-learning-loss-disparities-grow-and-students-need-help>.

Egalite, Anna. "How Family Background Influences Student Achievement," *Education Next* 16, no. 2 (Spring 2016): 70-76.
<https://educationnext.org/how-family-background-influences-student-achievement/>.

Garcia, Emma and Elaine Weiss, "Reducing and Averting Achievement Gaps," *Economic Policy Institute*. September 27th, 2017.
<https://www.epi.org/publication/reducing-and-averting-achievement-gaps/>.

Hashim, Shirin, Thomas Kane, Thomas Kelly-Kemple, Mary Laski, and Douglas Staiger. "Have Income-Based Achievement Gaps Widened or Narrowed?" National Bureau of Economic Research (August 2020).
https://www.nber.org/system/files/working_papers/w27714/revisions/w27714.rev0.pdf

Hanushek, Eric, Paul Peterson, Laura Talpey, and Ludger Woessmann, "The Achievement Gap Fails to Close." *Education Next* 19, no. 3 (Summer 2019): 8-17.
<https://www.educationnext.org/achievement-gap-fails-close-half-century-testing-shows-persistent-divide/>.

Hertzler, Lauren. "Meshing Academics and Fun for a Summer Program Like No Other." *Penn Today*, October 4th, 2021.
<https://penntoday.upenn.edu/news/penn-gse-netter-center-join-talents-inaugural-projects-progress-initiative>.

Hough, Heather. "Salary Incentives and Teacher Quality: The Effect of a District-Level Salary Increase on Teacher Recruitment." (2012).

<https://cepa.stanford.edu/content/salary-incentives-and-teacher-quality-effect-district-level-salary-increase-teacher-recruitment>.

International Mathematics Union Secretariat. "The Role of Mathematics in the Overall Curriculum." ICME Proceedings.

<https://www.mathunion.org/icmi/role-mathematics-overall-curriculum#:~:text=Mathematics%20provides%20an%20effective%20way,and%20even%20music%20and%20art>

Johnson, Clarence and William Kritsonis. "The National Dilemma of African American Students: Disparities in Math Achievement and Instruction," *National Forum of Applied Educational Research Journal* 20, no. 3 (2006):

<https://files.eric.ed.gov/fulltext/ED492116.pdf>.

Johnson, Greg. "Tutoring Project Gives West Philly Students a Leg Up on Learning." *Penn Today*, October 22nd, 2015.

<https://penntoday.upenn.edu/2015-10-22/features/tutoring-project-gives-west-philly-students-leg-learning>.

Jones, Tamara. "Interview with Om Manghani." Interview by Om Manghani. March 17, 2022.

Julia Robinson Math Festival. "Rook's Move." <https://www.jrmf.org/activities/rook-s-move>.

Kimball, Miles, Noah Smith, and Quartz. "The Myth of 'I'm Bad at Math.'" *The Atlantic*, October 28th, 2013.

<https://www.theatlantic.com/education/archive/2013/10/the-myth-of-im-bad-at-math/280914/>.

Koedel, Cory and Eric Tyhurst. "Math Skills and Labor Market Outcomes: Evidence from a Resume-Based Field Experiment." *Economics of Education Review* 31, no. 1 (2012): 131-140. <https://doi.org/10.1016/j.econedurev.2011.09.006>.

Kuhfeld, Megan, James Soland, and Karyn Lewis. "Test Score Patterns Across 3 COVID-19 Impacted School Years." EdWorking Paper (2022).

<https://www.edworkingpapers.com/sites/default/files/ai22-521.pdf>.

Lewis, Karyn, Megan Kuhfeld, Eric Ruzek, and Andrew McEachin. "Learning During COVID 19: Reading and Math Achievement in the 20-21 School Year," Center for School and Student Progress,

<https://www.nwea.org/content/uploads/2021/07/Learning-during-COVID-19-Reading-and-math-achievement-in-the-2020-2021-school-year.research-brief-1.pdf>

Lefkowitz, Mike. "Why is Math So Important?" *Mind Research Institute*.

<https://blog.mindresearch.org/blog/why-is-math-so-important>.

- Loveless, Tom. "Trends in Math Achievement: The Importance of Basic Skills," *Brookings*, February 6, 2003.
<https://www.brookings.edu/on-the-record/trends-in-math-achievement-the-importance-of-basic-skills/>.
- Lower Merion School District. "20-21 LMEA Salary Schedules."
https://www.lmeaonline.org/documents/contracts/2020-21_LMEA_Salary_Schedules.pdf.
- Mervosh, Sarah. "The Pandemic Hurt These Students the Most." *New York Times*, September 7th, 2021.
<https://www.nytimes.com/2021/07/28/us/covid-schools-at-home-learning-study.html>.
- Mezzacappa, Dale. "Hite Testifies Lack of Resources Hold Back Philly Students," *Chalkbeat*, January 11th, 2022.
<https://philadelphia.chalkbeat.org/2022/1/11/22879306/hite-testifies-lack-of-resources-holds-back-philly-students#:~:text=Philadelphia%20school%20superintendent%20William%20Hite,achieve%20academically%20at%20high%20levels>
- National Assessment of Educational Progress. "National Student Group Scores and Score Gaps." The NAEP Report Card: Mathematics.
<https://www.nationsreportcard.gov/mathematics/nation/groups/?grade=8>.
- Nearpod. "Nearpod Library."
<https://nearpod.com/t/7th-6th-8th-math-C377,389,386,261?t=100>.
- Niche. "Woodrow Wilson Middle School."
<https://www.niche.com/k12/woodrow-wilson-middle-school-philadelphia-pa/>;
- Pearman, Francis A. "The Effect of Neighborhood Poverty on Math Achievement: Evidence from a Value-Added Design." *Education and Urban Society* 51, no. 2: 289-307.
<https://doi.org/10.1177/0013124517715066>.
- Pew Trusts. "Philadelphia's Poor: Experiences from Below the Poverty Line." September 26th, 2018.
<https://www.pewtrusts.org/en/research-and-analysis/reports/2018/09/26/philadelphias-poor-experiences-from-below-the-poverty-line>.
- Preston, Caroline. "How Four Middle Schoolers Are Navigating the Pandemic." *PBS*, January 26th, 2021.
<https://www.pbs.org/newshour/education/how-four-middle-schoolers-are-navigating-the-pandemic>.

Quinn, David. "Kindergarten Black-White Test Score Gaps: Re-examining the Roles of Socioeconomic Status and School Quality with New Data." *Sociology of Education* 88, no. 2: 120-139.

<https://www.asanet.org/sites/default/files/savvy/journals/soe/Apr15SOEFeature.pdf>.

Reardon, Sean. "No Rich Child Left Behind." *The New York Times*, April 27th, 2013.

<https://opinionator.blogs.nytimes.com/2013/04/27/no-rich-child-left-behind/>

Reardon, Sean. "School Segregation and Racial Academic Achievement Gaps." *RSF: The Russell Sage Foundation Journal of the Social Sciences* 2, no. 5 (2016): 34-57.

<https://www.rsjournal.org/content/rsfjss/2/5/34.full.pdf>.

Robinson, Wade. "Interview with Om Manghani." Interview by Om Manghani. March 17, 2022.

Schwartz, Amy Ellen, Agustina Laurito, Johanna Laco, Patrick Sharkey, and Ingrid Gould Ellen, "The Academic Effects of Exposure to Neighborhood Violence," Center for Policy Research at the Maxwell School, Working Paper, no. 195,

https://www.minneapolisfed.org/~media/files/community/2017-conference/papers-and-presentations/concurrent1/schwartz_paper2_crime_508.pdf?la=en.

Stanford Center for Education Policy Analysis. "Racial and Ethnic Achievement Gaps." The Educational Opportunity Monitoring Project.

<https://cepa.stanford.edu/educational-opportunity-monitoring-project/achievement-gaps/race/>.

Sun, Faustine. "Interview with Om Manghani." Interview by Om Manghani. April 7th, 2022.

The School District of Philadelphia. "District Scorecard." District Performance Office.

<https://www.philasd.org/performance/programsservices/school-progress-reports/district-scorecard/#note>.

The School District of Philadelphia. "Julia R. Masterman School (Middle-High)." School Profiles.

<https://schoolprofiles.philasd.org/masterman/demographics>.

The School District of Philadelphia. "Woodrow Wilson School (Middle)." School Profiles.

<https://schoolprofiles.philasd.org/wwilson/overview>.

The School District of Philadelphia. 2018-19 End of Year Report: Julia Masterman School.

https://cdn.philasd.org/offices/performance/SPR_Files/2019-2020/Reports/2140_MS_EOYR_SY1920.pdf

School Digger. "Julia R Masterman Sec School," Philadelphia City School District.

<https://www.schooldigger.com/go/PA/schools/1899003808/school.aspx#:~:text=Compare%20Details%20Student%20population%20at,a%20free%20or%20discounted%20lunch>.

Tavernise, Sabrina. "Education Gap Grows Between Rich and Poor, Studies Say." *The New York Times*, February 9th, 2012, <https://www.nytimes.com/2012/02/10/education/education-gap-grows-between-rich-and-poor-studies-show.html#:~:text=Now%2C%20in%20analyses%20of%20long,substantially%20during%20the%20same%20period.>

Rothstein, Richard. "The Racial Achievement Gap, Segregated Schools, and Segregated Neighborhoods — A Constitutional Insult." *Economic Policy Institute*, November 12th, 2014, <https://www.epi.org/publication/the-racial-achievement-gap-segregated-schools-and-segregated-neighborhoods-a-constitutional-insult/>.

US Bureau of Labor Statistics. "Math Occupations." Occupational Outlook Handbook. Last modified April 18, 2022. <https://www.bls.gov/ooh/math/home.htm>.

US News and World Report. "Julia R. Masterman Secondary School." K-12 Education. <https://www.usnews.com/education/best-high-schools/pennsylvania/districts/philadelphia-city-school-district/julia-r-masterman-secondary-school-17216>.

US News and World Report. "Woodrow Wilson Middle School." K-12 Education. <https://www.usnews.com/education/k12/new-jersey/woodrow-wilson-middle-school-270335>.

US News and World Report. "Hamilton Andrew School." <https://www.usnews.com/education/k12/pennsylvania/hamilton-andrew-school-232382#:~:text=Overview%20of%20Hamilton%20Andrew%20School&text=The%20school's%20minority%20student%20enrollment,enrolls%20100%25%20economically%20disadvantaged%20students.>

Uthman-Olukun, Eros. "Interview with Om Manghani." Interview by Om Manghani. March 30th, 2022.

Sathi, Nicholas. "Interview with Om Manghani." Interview by Om Manghani. April 5th, 2022.

Simmonds, Theresa. Junior Jump Start Workbook.

Simmonds, Theresa. "The School District of Philadelphia, An Overview."

The School District of Philadelphia. "Salary Schedule Effective September 1, 2021." https://www.pft.org/sites/default/files/article_pdf_files/2021-10/21-22_pay_scale.pdf.

Vanderbilt University. "What is High Quality Math Instruction and Why is it Important?" Iris Center. <https://iris.peabody.vanderbilt.edu/module/math/cresource/q1/p01/>.

Wang, Jia and Pete Goldschmidt, "The Importance of Middle School Mathematics on High School Students." *The Journal of Educational Research* 97, no. 1 (2003): 3-19.

<https://psycnet.apa.org/record/2003-10445-001>.

Wasserman, Miriam. "Ready for Kindergarten? Gap Between Rich and Poor Narrows, Stanford Study Finds." *Stanford News*, August 26th, 2016.

<https://news.stanford.edu/2016/08/26/kindergarten-ready-gap-rich-poor-narrows/>.

Williams, Jasmine. "Interview with Om Manghani." Interview by Om Manghani. April 1st, 2022.

Williams, Jasmine. "Interview with Om Manghani." Interview by Om Manghani. April 7th, 2022.

Zhu, Chelsea. "When Tutoring Programs Fail." *34th Street Magazine*. October 9th, 2014.

<https://www.34st.com/article/2019/10/tutoring-programs-netter-center-philadelphia-public-schools-training-white-savior-pilots-transitory-disparity-inequality-students/>.