PRINCETON PUBLIC SCHOOLS

MATHEMATICS PROGRAM EVALUATION REPORT

November 2023

ADL
Meaningful Teaching & Learning

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INTRODUCTION

This evaluation report is the result of a collaborative effort between the Princeton Public Schools and Angela Di Michele Lalor Consulting to assess the extent to which the Princeton Public Schools Mathematics Program provides an excellent mathematics education that encourages each student to achieve at a high level. This report seeks to provide stakeholders, including educators, caregivers, students, the Princeton Public Schools Board of Education, and community members, with an accurate assessment of the program's achievements, challenges, and areas that require improvement in achieving this goal.

The Program Evaluation Team's commitment, knowledge, and insights significantly enriched the evaluation process, providing a deeper understanding of the mathematics program's impact on student learning and areas for improvement. The team's collaborative spirit and dedication have been instrumental in ensuring that this report is not only thorough but also reflective of the collective aspirations and efforts invested in enhancing mathematics education within the district.

The findings from the evaluation project are available at three levels of detail.

1. **Executive Summary:** An overview of the project's structure, methodologies, key findings, conclusions, and recommendations.
2. **Full Report:** A detailed description of the program evaluation structure, data collected, and overall conclusions and recommendations.
3. **Sub-reports:** Individual reports focused on the evaluation questions. Each sub-report includes research, data, findings, and specific conclusions and recommendations. Sub-reports can be found as appendices.

The information and recommendations aim to not only highlight the program's assets but also guide its continuous improvement and long-term success in delivering high-quality mathematics education to students.

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Evaluation Questions

Princeton Public Schools contracted Angela Di Michele Lalor Consulting to evaluate the district's mathematics and computer science programs. The Request for Proposal (RFP) and the mathematics department mission statement were used to generate questions to guide the review:

1. **Excellent Mathematics Education:** How do students receive an excellent education that prepares them for high-level mathematics?
2. **Teaching and Learning:** What instructional practices and routines do teachers use to prepare students for high-level mathematics? How are teachers supported in implementing curricula that lead to high-level mathematics?
3. **Equity and Access:** How are students provided with equitable pathways to achieve high-level mathematics and supported to be successful?
4. **Computer Science:** How do students prepare for and engage in rigorous computer science education?
5. **Next Steps:** What are the next steps in developing an excellent and equitable mathematics and computer science education for all students?

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Data Sources

Data was collected from three sources to provide a response to each review question. The first source was written, taught, or assessed curricula. The second was documents related to relevant systems and/or structures, and the third was perceptual data collected through surveys and focus groups from stakeholders, including students, caregivers, educators, and members of the Princeton Public Schools Board of Education.

Question	Type of Curricula	Systems and Structures	Perceptual Data
Q1 Excellent Education	Written curricula such as Rubicon Atlas curriculum maps and units, and related textbooks and resources	Course placement system, including assessment blueprints, placement rubrics, and placement presentations	Surveys and focus group observations from students, caregivers, educators, and members of Princeton Public Schools Board of Education
Q2 Teaching and Learning	Taught curricula gathered during classroom visits	District professional development calendar	
Q3 Equity and Access	Assessed curricula as documented on district-wide and state assessments	District demographic and enrollment data, and support classes and structures for students	
Q4 Computer Science	Written curricula such as Rubicon Atlas curriculum maps and units	Enrollment data and pathways	Teacher focus group

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Timeline and Data Collected

Timeline

April 2023 — November 2023

Data Collected:

Surveys

- **1,728 Students**
- **309 Caregivers**
- **57 Educators**

Focus Groups

- **74 Caregivers**
- **62 Students**
- **28 Educators**

Classroom Visits

- **24**

Documents

- **107**

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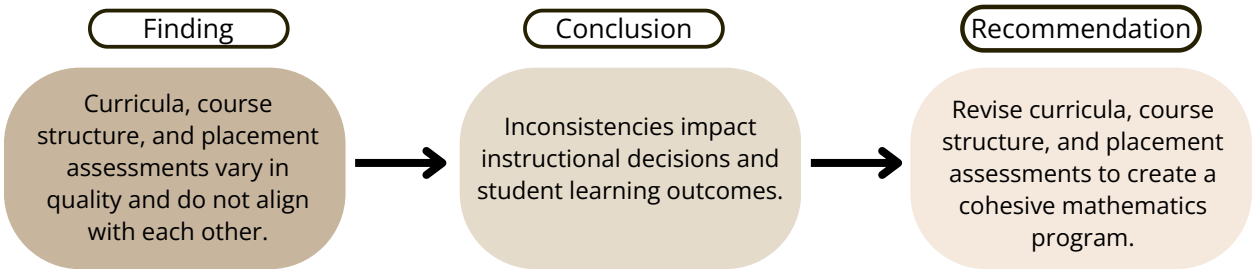
Excellent Education

Below are findings, conclusions, and recommendations related to the quality of mathematics curriculum in the Princeton Public Schools. Curricula is foundational to providing students with an excellent education. In addition, the course placement assessments are analyzed because strong alignment between the course curricula and assessments is necessary to ensure the validity and reliability of the placement process.



Findings

The written curricula vary in quality and are underutilized by educators. The elementary school curricula are resource-dependent. They do not delineate instructional priorities, emphasize standards for mathematical practice, or demonstrate the coherence of mathematical learning across grade levels. In addition, they do not explicitly identify grade-level standards that develop algebraic thinking.

The secondary curricula demonstrate strong alignment with standards and address the underlying principles of the mathematical standards. However, the number of standards and the organization of the standards in the middle school courses, Pre-Algebra Accelerated, Algebra I Part 1, and Algebra I Part 2, do not support positive student learning outcomes for all students. These course names also do not accurately reflect what is taught or align with the course assessment. “Accelerated” is overused as four of the six courses available at the middle school are labeled as such. The curricula for courses taught at the middle school and high school levels are not the same.

The LinkIt course placement assessments align with individual standards for the grade level or course completed. However, the readiness assessments do not fully represent the critical areas or course standards in which students will be placed. They do not explicitly assess the standards for mathematical practice. The level of mathematical reasoning measured varies across assessments. The course placement system relies on on-demand assessments.

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Conclusions

As elementary curricula have insufficient information, teachers do not have access to the essential information they need to make instructional decisions and, therefore, rely on their textbooks. As a result, students may not fully be prepared for the advanced coursework at the middle school. Students at the middle school are enrolled in courses with unreasonable numbers of standards that require individual teachers to prioritize standards and content. Middle and high school curricula for the same courses are different, implying that the expectations for students may vary based on where and when they take the course. Teachers do not routinely use the curricula to make instructional decisions, which may account for the differences in classroom practice reported by teachers and noticed in the classroom.

While the placement assessments strongly align with individual standards, they may not accurately report on student readiness. Discrepancies exist between the standards measured by the course placement assessments and the standards articulated in the written curriculum for courses in which students will be placed.

Recommendations

Revisions are needed to strengthen the elementary curricula to ensure they address foundational principles of the New Jersey Learning Standards in Mathematics. Revisions include emphasizing the standards for mathematical practice and highlighting grade-level standards that develop algebraic thinking.

At the middle school, revisions to the curricula are needed to reorganize standards. Strategically leveraging progressions will support students in developing deep conceptual understanding, fluency, and mathematical reasoning. Curricula for courses taught at the middle and high school need to be revised to ensure they hold students to the same high expectations. The term “accelerated” should be used uniformly across buildings. Curricula need to be integrated into professional learning experiences so teachers routinely use curricula to make instructional decisions. In addition, the assessment, grading and reporting, and student support systems must align with the curricula.

Course placement assessments require revision. Revisions include aligning questions to domains, clusters, and individual standards; assessing the standards for mathematical practice; and increasing the thinking demand of questions. These revisions should be completed after courses are revised to ensure strong alignment with course standards and accurate placement. The course placement process should be revised to incorporate multiple measures.

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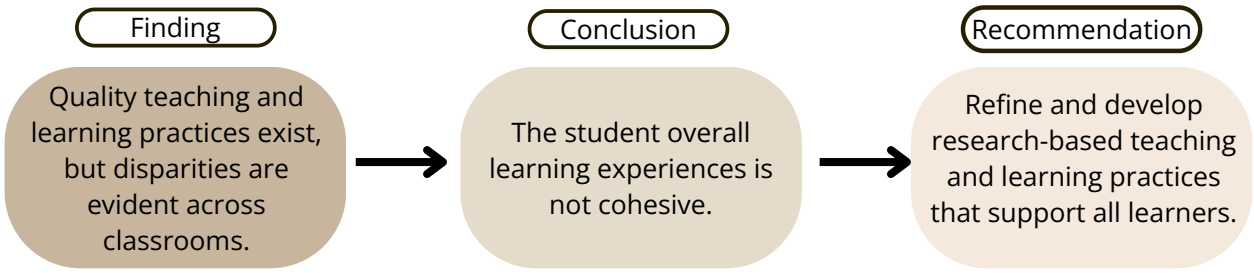
Effective Teaching and Learning



Findings

Quality teaching and learning practices were observed in classroom visits and reported by educators, caregivers, and students. Students actively work collaboratively and independently to engage in challenging tasks using varied strategies and representations. However, these practices are dependent on individual teachers, and discrepancies exist across classrooms. Many classrooms, particularly at the secondary level, are teacher-directed. Surveys and classroom visits revealed that there are limited opportunities for students to engage in mathematical discourse, use mathematical practices for learning, or apply mathematics to authentic situations. There are also disparities in effective differentiation as caregivers and students report that students are not challenged in their mathematics classes, or they are underprepared for subsequent coursework. Many caregivers provide assistance at home or seek outside support to address student learning needs.

Conclusions

There is an overreliance on teacher-directed practices. Whole group instruction limits students' engagement and does not support differentiation. Differentiated instruction is necessary for meeting the wide range of learning needs, whether students need additional time or support, or exceed grade-level expectations. Addressing the variety of student learning needs in the classroom may lower the need for caregivers to seek outside support and better prepare students for the advanced coursework at the middle school.

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Recommendations

Teachers would benefit from a variety of professional learning opportunities to develop research-based practices that support student learning. The foci of professional learning should include student-centered instructional practices, differentiated instruction, and equity-focused instructional strategies addressing students' diverse cultural, social, and learning needs. Professional learning opportunities do not necessarily require stand-alone initiatives. They can include tapping teacher leaders, routinely engaging with LinkIt and other assessment results during data meetings, and strategically utilizing existing expertise within the community of Princeton. Teachers, regardless of their years of experience or level of expertise, enhance their practice when they engage as a learning community to deepen their understanding of best practices, collaborate, and exchange instructional strategies. Opportunities for cross-grade collaboration are necessary for building a coherent mathematics program.

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Equity and Access

Finding	Conclusion	Recommendation
The demographics of the district are not represented in the enrollment of advanced courses.	Students do not have the supports, learning experiences, and pathways that provide access to advanced courses.	Revise curricula, instructional practices, the placement system, and support structures.

Findings

Student learning needs are addressed through Individual Education Programs, the QUEST Multi-Tiered System of Support, and advanced course offerings in mathematics at the middle and high school. Students have a wide range of advanced course options in mathematics at the secondary level, with course options extending beyond those that are typically found at the middle and high school levels. In-school support is available during FOCUS, PAWS, Tiger Time, Plus at the high school, and the new support class at the middle school. Course enrollment in advanced courses at the middle and high school levels does not reflect the diversity of the student population based on race and ethnicity, language, free and reduced lunch eligibility, and students who receive special education services. Course enrollment demonstrates that Black and Hispanic students represent a larger proportion of students enrolled in special education mathematics courses.

Conclusions

Princeton Public Schools provides several program options to address the needs of diverse learners, including students with disabilities, multilingual learners, and gifted learners. The supports in place are insufficient in addressing the needs of all students. Black and Hispanic students, students who receive free and reduced lunch, students who receive special education services, and multilingual learners are consistently underrepresented in advanced courses at middle and high school.

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Recommendations

The development of a coherent and cohesive mathematics program is necessary to provide access to high-level mathematics and advanced courses. Achieving this goal begins with revision to the mathematics curricula to emphasize mathematical reasoning at all levels and the development of algebraic thinking at the elementary level. Restructuring courses at the middle school will provide more focused instruction and build a stronger foundation for advanced courses.

Student support structures and learning environments are needed for students who need more time to develop deep conceptual understanding and those who need additional challenges. Data-driven instruction is necessary for differentiating instruction at all levels. Incorporating authentic, meaningful performance tasks and learning experiences can enrich the relevance of mathematics to students' lives. Asset-based approaches to learning are necessary to build students' mathematical identity and agency so they continue pursuing mathematics at the high school level.

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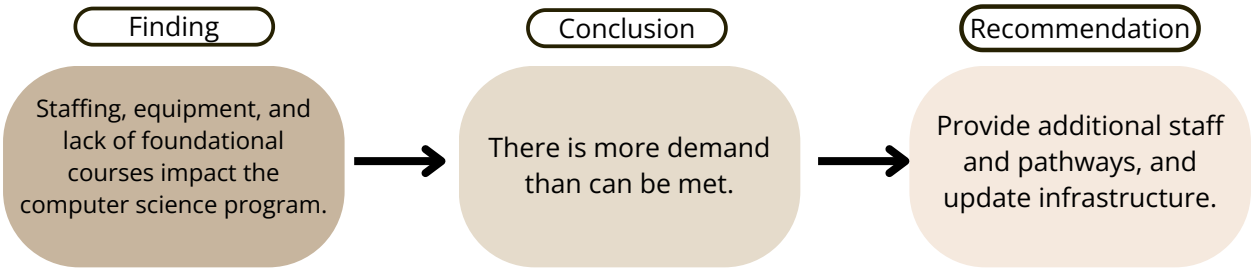
Computer Science



Findings

Computer science classes are in high demand, but there are only two computer science teachers, which impacts the availability of classes. Alternative strategies, such as the Python Portfolio Independent Study, have been used to increase access. Enrollment in computer science classes does not reflect the gender, racial, ethnic, linguistic, and socioeconomic diversity of the high school. Currently, there is no integration of computer science standards at the elementary level and limited access to computer science courses at the middle school. High school curricula for computer science exist, but they need to be updated to align with the New Jersey Learning Standards for Computer Science and Design Thinking.

Conclusions

The quality of computer science education is hindered by challenges in infrastructure and resources, including outdated classrooms and a shortage of teachers. The lack of exposure to computer science standards and programs prior to high school may impact interest, access, and diversity in high school courses.

Recommendations

Investments should be made in modernizing classrooms to create interactive environments conducive to collaboration and learning. Initiatives should be implemented to increase diversity in computer science classes, including the establishment of mentorship programs. Curriculum updates are needed to align courses and programs with the New Jersey Learning Standards for Computer Science and Design Thinking. Curricula revisions should include efforts to integrate computer science into the elementary and middle school curricula.

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Next Steps

Princeton Public Schools is committed to providing all students with an excellent mathematics education, as seen through the many changes in programming that have occurred in past years in response to the evolving needs of students. However, these changes have resulted in inconsistencies and lack of coherence in the mathematics program. In addition, these changes may have undermined trust in the system's capability to meet student learning needs. It is the recommendation of the ADL Team that a more systemic approach be used moving forward to build the collective efficacy necessary to achieve and sustain Princeton Public Schools' goal of providing all students with an excellent mathematics education.

The ADL Team recommends that the district develop a strategic mathematics plan that includes the following actions. These actions incorporate the above recommendations and are intended to be implemented over time to allow the system to maintain quality, adjust to changes, and be the least disruptive to student learning.

01 Coherence

Mission and Vision: Educators, caregivers, and students provided feedback that indicates differing views on the objectives of the mathematics program and what instructional methods should be used in the classroom. While Princeton Public Schools Mathematics Department has a clearly articulated mission statement, it is recommended that educators review this statement to recommit to or revise the program's mission and articulate a vision for mathematics education. This process needs to involve members of all schools, including elementary and secondary educators, special education educators, dual language immersion and multilingual learner educators, and other instructional support staff. It is the shared responsibility of all educators to understand the direction and long-term objectives of the mathematics program and work toward achieving its goals. Educators can then integrate the vision and mission into all communications so the purpose behind the mathematics program decisions is aligned and transparent to all stakeholders.

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Professional Learning: The proposed recommendations for Princeton Public Schools emphasize the importance of professional learning for educators. Professional learning opportunities should integrate the foundational principles of the New Jersey Learning Standards for Mathematics while addressing best practices in teaching and learning. Additionally, all educators would benefit from professional learning focused on assessment literacy, specifically on using formative assessments to differentiate instruction. Professional learning focused on leveraging students' culture, experience, and language is necessary to support all students in achieving high levels of mathematics.

02 Collaboration

Clear and focused professional learning opportunities in various settings and contexts enable teachers to further develop their teaching and learning practices, positively impacting student learning. Regardless of their level of experience or expertise, teachers can enhance their practice when they engage as a learning community to deepen their understanding of best practices, collaborate, and exchange instructional strategies. Cross-grade collaboration would equip teachers with the tools, knowledge, and support to provide students with high-quality mathematics instruction and a more coherent learning experience for students.

03 Communication

Communication consistently emerged as a need among all stakeholders: educators, caregivers, and students. Teachers need more time to communicate within and across grade levels. Effective communication with students about their progress and achievement is necessary for improving student self-regulation and agency. Communication with stakeholders is crucial for creating a collaborative and supportive school community. It is important to regularly update caregivers about classroom and school-wide initiatives, using a variety of channels. Communication with caregivers must be improved to build trust that the mathematics program will meet the needs of their children.

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The ADL Team suggests that the recommendations from this report be implemented in phases to ensure the development of a cohesive and sustainable mathematics program. The following diagram offers an approach for addressing recommendations and next steps.

Phase One

- Create a cross-grade mathematics team.
- Revisit the mathematics mission and vision.
- Develop a strategic plan for mathematics.
- Develop a mathematics professional learning plan that includes addressing underlying principles of the New Jersey State Standards and vertical alignment.
- Develop a plan for ongoing and consistent communication with caregivers.
- Explore options for increasing staff and improving computer science facilities.

Phase Two

- Revise the middle school curricula.
- Revise the elementary school curricula.
- Revise the course placement assessments.
- Provide professional learning opportunities focused on research-based teaching and learning practices.
- Identify options and develop a plan for growing the computer science program.

Phase Three

- Examine connections across all systems, including grading and reporting, and multitiered support systems.
- Integrate computer science standards into elementary and middle school curricula.

Phase Four

- Examine learning data to measure impact and readjust as necessary.

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Conclusion

Educators, caregivers, and students are passionate about mathematics. Their dedication to high-quality mathematics can be fostered to develop the collective efficacy needed to build a mathematics program that addresses the needs of all learners. Collective efficacy refers to the shared belief that a group can collectively achieve desired goals, overcome challenges, and make a positive impact through their combined efforts. Through collaboration and the development of productive beliefs about mathematics education, stakeholders can take actions in alignment with those beliefs that will enhance the learning outcomes for all students within Princeton Public Schools.

Full Report

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Background

Evaluation Purpose:

Princeton Public Schools contracted Angela Di Michele Lalor Consulting to assess the quality of its mathematics and computer science programs. The review aimed to evaluate the written, taught, and learned mathematics curriculum and to utilize current research and effective instructional practices to assess mathematics education, including best practices in course sequencing and offering equitable pathways. The review also aimed to support the development of a shared vision for quality instruction among leaders, faculty, and staff and codevelop a strategic plan for professional learning.

Evaluation Questions:

The ADL Team members engaged in a collaborative process with district administrators and teachers to gather and analyze data to answer the following questions:

1. **Excellent Mathematics Education:** How do students receive an excellent education that prepares them for high-level mathematics?
2. **Teaching and Learning:** What instructional practices and routines do teachers use to prepare students for high-level mathematics? How are teachers supported in implementing curricula that lead to high-level mathematics?
3. **Equity and Access:** How are students provided with equitable pathways to achieve high-level mathematics and supported to be successful?
4. **Computer Science:** How do students prepare for and engage in rigorous computer science education?
5. **Next Steps:** What are the next steps in developing an excellent and equitable mathematics and computer science education for all students?

Program Evaluation Team

The Princeton Public Schools Program Evaluation Team was created to conduct a comprehensive and insightful assessment of the mathematics program. Educators were invited to participate, and additional requests were made to ensure that the team consisted of educators from various grade levels, roles, and responsibilities. The following list provides an overview of the individuals who generously contributed their time and expertise to the project:

- Dr. Kimberly Tew, Assistant Superintendent for Curriculum and Instruction
- Sarah Moore, Supervisor of Elementary Education
- Eric Csolak, Supervisor of Student Services, Age 3–Grade 5
- Crystal Riddick, Supervisor of Student Services, Grade 9–Age 21
- Tiffany Brennan, 6–12 Mathematics and Business Supervisor
- Jason Burr, Principal, Princeton Middle School
- Dr. Angela Siso Stentz, Principal, Johnson Park Elementary School
- Marian Figueroa-Toro, Dual Language Immersion Teacher, Community Park Elementary School
- Rosanna Paco, Bilingual Special Education Teacher, Community Park Elementary School
- Stacey Tuliszewski, 5th Grade Teacher and Curriculum Team Leader for Mathematics, Riverside Elementary School
- Jennifer Crowder, Language Learner Disabilities Teacher, Johnson Park Elementary School
- Donna Eisenacher, 3rd Grade Teacher and Curriculum Team Leader for Mathematics, Johnson Park Elementary School
- Alicia Carsdale, 6th Grade Math Teacher, Princeton Middle School
- Daniel Lee, 6th Grade Math Teacher, Princeton Middle School
- LaToya Waddell, 7th Grade Math Teacher, Princeton Middle School
- Kristin Hill, 8th Grade Math Teacher, Princeton Middle School
- Sarah Ayad, Math Teacher, Princeton High School
- Brent Ferguson, Math Teacher, Princeton High School
- Lauren Freedman, Math Teacher, Princeton High School

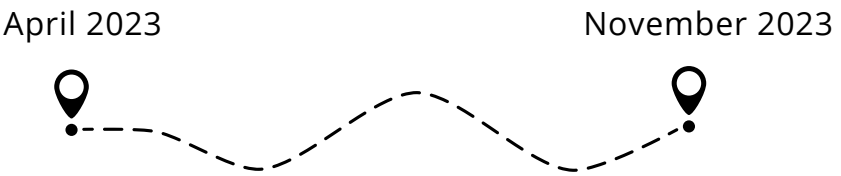
Program Evaluation Team Facilitators and Lead Evaluators

Angela Di Michele Lalor is an educational consultant who has facilitated school-wide professional development initiatives for 25 years across the country. Angela is the author of two ASCD publications, *Making Curriculum Matter: How to Build SEL, Equity, and Other Valued Priorities into Daily Instruction* and *Ensuring High-Quality Curriculum: How to Design, Revise or Adopt Curriculum Aligned to Student Success*. Angela is a frequent contributor to Edutopia. She regularly presents at ASCD National Conferences and facilitates webinars for NYSASCD.

Judy Barbera is an experienced educator with a passion for facilitating learning. During her 40-year career in a suburban New York State school district, she developed a systemic instructional perspective through her service as a high school mathematics teacher, an elementary school principal, and an assistant superintendent for instruction. As a consultant with the McKay Consulting Group, Judy provides regional- and district-level services in the area of leadership development with an emphasis on supervision and evaluation of professional practice. She also facilitates professional learning designed to strengthen student engagement. Judy Barbera is a consultant and staff developer affiliated with AVID Center. She facilitates adult learning opportunities nationally through their Leadership Division and provides school-based support throughout the northeast region.

Charles Sperrazza has over 25 years experience in New York public schools. His educational career began as a classroom teacher, aspiring principal, principal-administrator, and mentor. He has worked extensively around curriculum and assessment. He has received numerous awards including Ambassador Principal from Center for Educational Innovation (CEI) and Principal of the Year Award – Forum of Italian American Educators (FIAME). He has recently coauthored with Angela Di Michele Lalor “How School Leaders Can Support Effective Professional Development: A professional development specialist and a principal describe how they work together to ensure that PD is meaningful.” Edutopia, September 22, 2022.

Timeline



April 18, 2023: The District Administrator Team met via Zoom to review the Princeton Public Schools Program Evaluation Plan. The ADL Team gathered demographic and student learning data on course enrollment, completion, and achievement.

April 27, 2023: The Program Evaluation Team met to establish criteria to evaluate the mathematics curriculum and instructional program by examining the following:

- Princeton Public School Mission, Values, and Approach
- New Jersey Student Learning Standards for Mathematics
- Research in best practices in mathematics instruction

May 2, 2023: The District Administrators Team met to review criteria generated by the Program Evaluation Team and plan for school visits.

May 11, 2023: The Program Evaluation Team met via Zoom to review tools for classroom visits.

May 23 and 24, 2023: The ADL Team and the Program Evaluation Team conducted classroom visits to gather information on the use of teaching and learning practices. The ADL Team also met with educators, caregivers, and student focus groups.

May–June 2023: Perceptual data was collected from educators, caregivers, and students through surveys.

June 7, 2023: The Program Evaluation Team met to analyze student data collected from classroom visits.

June–August 2023: Data collected was analyzed by the ADL Team.

August 21, 2023: A summary of the findings, conclusions, and recommendations were shared and discussed with the District Administrator Team.

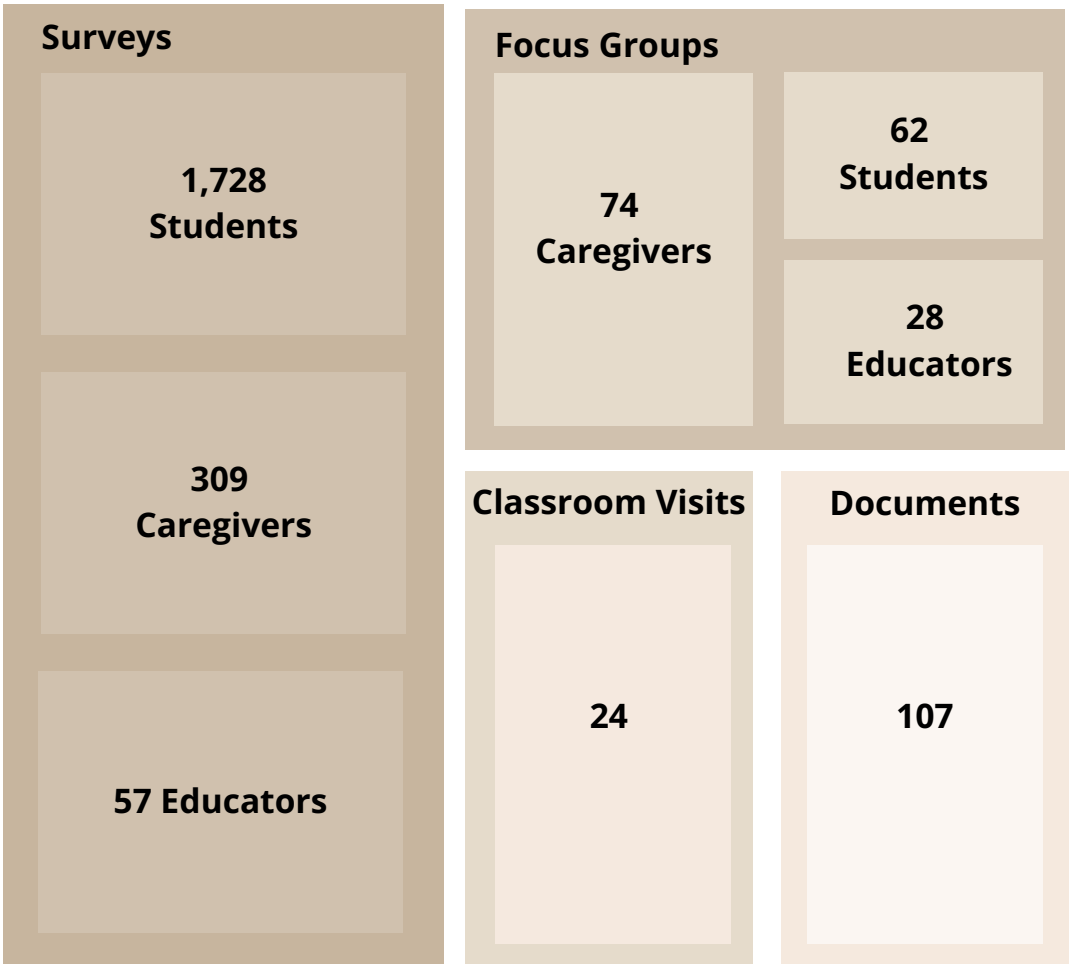
September 19, 2023: A summary of the findings, conclusions, and recommendations was shared and discussed with the Program Evaluation Team.

October 31, 2023: The Executive Summary was shared with the Student Achievement Committee (SAC).

November 21, 2023: Presentation to the Board of Education

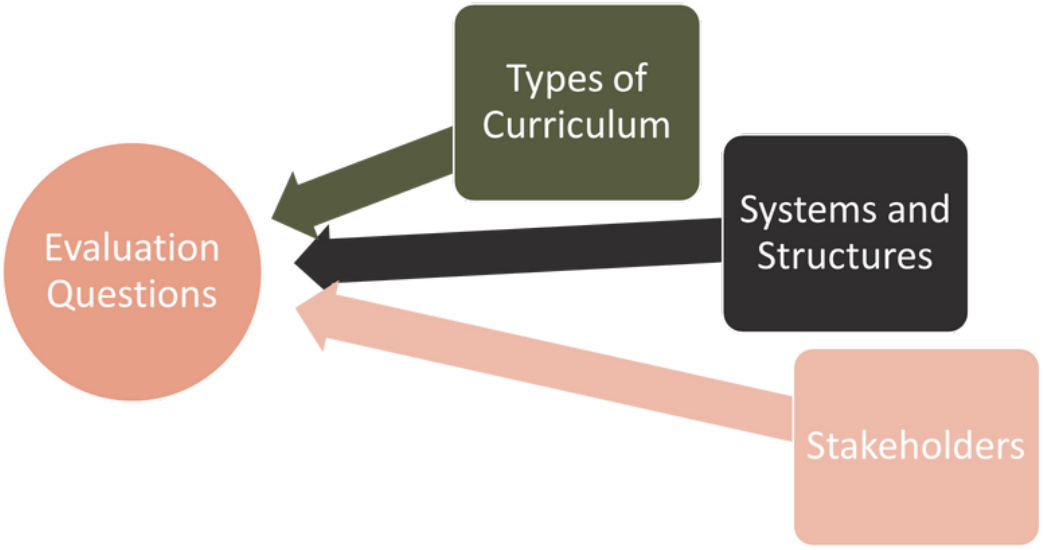
Throughout the process, there was ongoing communication with district administration through virtual meetings. Modifications to the evaluation process were made based on feedback from the Program Evaluation Team.

Data Collected



Approach

In the evaluation of the Princeton Public Schools Mathematics Education Program, the ADL Team examined data for each evaluation question separately. The ADL Team used a combination of documents, surveys, and focus groups to gather data about various aspects of the mathematics program, including the curriculum, placement process, assessment system, teaching and learning practices, and structures for supporting equity and access.



The ADL Team concentrated on reviewing documents, systems, and structures to build a foundational understanding of the program's framework. The analysis of the survey data followed. Open-ended survey question responses, as well as classroom visit and focus group information, were used to enrich insights and complement the survey data.

The surveys were designed with specific focus areas in mind, aligning questions with each key aspect of the program. This strategic structuring was essential in optimizing the data collection process. This approach enabled the ADL Team to effectively collect information pertinent to each sub-report.

Given the varied nature of the data sources, different analytical techniques were applied accordingly. The team employed a “Here’s What, Now What, So What” framework to distill and interpret the data collected. This approach was utilized to identify trends and patterns, which formed the basis for drawing well-grounded conclusions about different aspects of the program.

The Program Evaluation Team actively participated in the analysis of the student survey data. Analyzing student responses provided educators with a deeper understanding of the student experience within the mathematics program in Princeton Public Schools.

The ADL Team acknowledges the limitations and challenges of the evaluation, such as potential biases in self-reported data and constraints of available data sets. The approach, however, included a continuous feedback loop, where preliminary findings were shared for feedback, ensuring that the evaluation remained relevant, accurate, and aligned with the program’s objectives.

Throughout the evaluation process, the ADL Team actively communicated with district administrators. Input from district administrators was invaluable in providing context, clarifying information, and providing additional data when requested.

The findings from the data sources were used to draft the sub-reports. The findings, conclusions, and recommendations from the sub-reports were then integrated to ensure comprehensive analysis and the identification of actionable recommendations.

Findings, Conclusions, and Recommendations

The findings, conclusions, and recommendations presented in this section are a culmination of those shared in the sub-reports. Each sub-report focuses on an individual evaluation question and provides detailed findings, conclusions, and recommendations. The full potential of the recommendations from the sub-reports will only be realized if they are approached as interconnected and interdependent. The connections between an excellent education, effective teaching and learning, and equity and access must be leveraged to truly impact student learning outcomes. With this in mind, the conclusions and recommendations presented in this section of the full report offer additional guidance on how to maximize the relationship among these areas and make targeted improvements that will benefit all students.

The aim of these conclusions and recommendations is to guide Princeton Public Schools in creating a strategic plan that will yield a long-lasting and positive impact. The report's Next Steps section offers suggestions for achieving this goal.

Excellent Education

A high-quality curriculum is foundational for ensuring students have access to high-level mathematics and an excellent mathematics education. As stated in Principles to Action, "inequitable learning opportunities can exist in any setting, diverse or homogenous, whenever only some, but not all, teachers implement rigorous curricula or use effective teaching and learning strategies" (NCTM, 2014).

The written curriculum guides teacher decision-making about learning targets, instruction and assessment practices, and student learning activities. While individual teachers or small teams of teachers may have a great depth of understanding of what is taught and why, equity and access call for a collective understanding. Clarity from a documented curriculum supports teachers in designing meaningful lessons and for students to engage in their learning. Teacher clarity has an effect size of 0.75 on student learning (Hattie et al., 2017). Without a shared understanding of grade-level expectations, there is an increased likelihood of greater variations in instruction across classrooms, making it much more difficult to create coherent learning experiences for students. In addition, vertical articulation assists teachers in building on students' prior knowledge.

A written curriculum differs from a textbook or resources because a written curriculum provides guidance on how to use the textbook or resources to address the valued outcomes desired by the school district for its students. In Princeton, the community has clearly communicated that it values high levels of mathematics and advanced coursework. Caregivers believe their children excel or are good at mathematics (79.4%). Caregivers have high expectations for their children, with 82% wanting their child to take Calculus and above and AP courses in high school. It is apparent that caregivers believe in their children's capabilities, and the importance of mathematics drives their pursuit of an excellent mathematics program in the Princeton Public Schools.

Detailed findings, conclusions, and recommendations on foundational aspects of an excellent education, such as written curriculum, course organization, and placement, can be found in Sub-Report 1. The findings, conclusions, and recommendations presented here discuss how the written curricula, course organization, and placement system impact teaching and learning and equitable access to high-level and advanced coursework in mathematics.

Areas of Strength

Attributes of quality exist with the systems and structures that set the foundation for an excellent mathematics education. They include a written curriculum at the secondary level that addresses the attributes of high-quality curricula and the underlying principles of the New Jersey State Learning Standards. The resources used by educators to support mathematical instruction are highly rated by EdReports, an independent nonprofit organization that reviews K–12 instructional materials in English language arts, mathematics, and science. Some of the placement assessments have supporting test blueprints to demonstrate validity.

Areas in Need of Improvement

1. Teachers do not use the written curriculum to make instructional decisions.
2. The written elementary school curriculum does not adequately communicate the information teachers need to prepare students for the compacted courses at the middle school.
3. The written curricula for middle school courses are not organized to support productive learning outcomes for students.
4. The quality of some course placement assessments and the lack of multiple measures raise concerns about the placement process.

Overarching Recommendation

To reach its goal of providing all students with high-level mathematics, Princeton Public Schools must have its own specialized curriculum that teachers routinely use to make instructional decisions. An articulated curriculum would create a cohesive mathematics learning experience for students. All other systems, including the assessment system, the grading and reporting system, and the course placement system, must then align with curricula. This is necessary for accurate ongoing communication of student progress and achievement to the student and caregiver and, ultimately, the assessment and placement of students in mathematics courses.

Teachers do not use the written curriculum to make instructional decisions.

A significant number of teachers (70%) across all grade levels reported that they do not use the written curriculum to inform their instructional decisions.

Elementary school teachers (91%) reported using *Ready Mathematics* to guide instruction in place of a written curriculum. While EdReports highly recommends *Ready Mathematics*, it has not been designed to address the specific goal of Princeton Public Schools to prepare students for advanced courses at the middle school. *Ready Mathematics* does not explicitly address algebraic thinking. In addition, teachers may not have a deep understanding of how *Ready Mathematics* is aligned with the underlying principles of the New Jersey Learning Standards in Mathematics, therefore, missing out on valuable information that could be leveraged to meet the diverse needs of learners in their classrooms.

At the secondary level, all middle school teachers and a majority (78%) of high school teachers depend on supplementary materials such as Desmos, GeoGebra, Canvas, and DeltaMath rather than using the written curriculum or the SAVVAS enVision® textbook. Secondary teacher survey responses indicate that they are confident to teach the required mathematics content effectively. However, this perspective does not consider the purpose of a written curriculum in ensuring vertical and horizontal alignment to adequately prepare all students for advanced coursework. It also overlooks the role of a written curriculum in aligning various educational systems, including assessments, grading and reporting, and course placement.

2 The written elementary school curriculum does not adequately communicate the information teachers need to prepare students for the compacted courses at the middle school.

A high-quality curriculum strongly aligns with state standards and related underlying principles. Important information such as the standards for mathematical practice, levels of content emphasis, and communication of standards progressions are not adequately emphasized in the written curriculum at the elementary level. As a result, information for teachers to make decisions that address the wide range of learners is not readily available. The ability of the program to meet the needs of students was an issue of the mathematics program widely reported by caregivers and students.

To effectively support a mathematics program designed to prepare students for advanced courses, it is essential to identify standards and learning activities that foster algebraic thinking. This information is absent from the Princeton Public Schools curricula, despite its necessity for adequately preparing students for the condensed curricula of middle school courses.

3 The written curricula for middle school courses are not organized to support productive learning outcomes for students.

The secondary curricula are well designed and adhere to the guidelines for quality curricula. Units of study highlight the level of emphasis and standards progressions and provide links directly to tasks aligned with unit standards, making it a helpful resource for instructional decisions in the classroom.

There is a concern about the curriculum organization for the Pre-Algebra Accelerated, Algebra I Part 1, and Algebra I Part 2 courses. These courses contain a large number of standards. For example, the 6th grade Pre-Algebra Accelerated course, in addition to the required 55 Grade 6 standards, also includes 30 standards from the 7th grade New Jersey Learning Standards. As a result, the total number of standards in this course reaches 85.

For a detailed number of standards in Pre-Algebra Accelerated, Algebra I Part1, Algebra I Part 2, see Sub-Report 1.

The organization of standards in the Pre-Algebra Accelerated, Algebra I Part 1, and Algebra I Part 2 courses presents a challenge. These courses do not effectively align with the structured progression outlined in the New Jersey Learning Standards for Mathematics. The arrangement of standards could make it difficult for teachers to use classroom time efficiently to focus on crucial concepts within the mathematical domains.

In Pre-Algebra Accelerated, Algebra I Part 1, and Algebra I Part 2, students are evaluated on only some of the standards taught in that course. For example, the New Jersey Learning Standards Mathematics Assessment for 6th grade, as well as the LinkIt Form A, B, and C, evaluates Pre-Algebra Accelerated students on the 55 Grade 6 standards. This is problematic because it is difficult to ascertain and report on student achievement and progress for the entire course (in the case of the Pre-Algebra Accelerated course, 85 standards). Consequently, teachers might prioritize content that will be assessed and spend less time on standards that are foundational to future courses. Additionally, caregivers might not receive a comprehensive view of student progress and achievement across all course standards. For a more in-depth analysis of the standards and assessments in Algebra I Part 1 and Algebra I Part 2, refer to Sub-Report 1.

> "When testing children, it should be based on a comprehensive curriculum they have learned."

> "I hear from many of the kids/parents, and I've seen from my child, that there is frustration with what is taught vs. what is assessed. There seems to be a widespread disconnect in many of the math courses between the class lessons and what shows up on tests and quizzes."

Caregivers observed discrepancies between curriculum, instruction, and assessment.

The names of the Pre-Algebra Accelerated, Algebra I Part 1, and Algebra I Part 2 courses are confusing because they do not adequately describe what students will learn and how they will be assessed, as described above. In addition, the term "accelerated" is widely used to describe mathematics courses at middle school. The term "accelerated" is misleading in the context of the Pre-Algebra course and is recommended to be removed. "Accelerated" is also unnecessary in describing the content of Algebra I. All students will complete the same Algebra I course before leaving middle school. Similarly, if the Algebra II and Geometry courses follow the same curriculum at the high school, the term "accelerated" is not necessary.

In addition, overuse of the term "accelerated" harms students' mathematical identity by encouraging a competitive mathematical environment or perpetuating a fixed mindset, as demonstrated by these students' reflections. One 7th grade student who, when asked which course, Algebra II or Geometry, she would like to take in 8th grade, responded by asking, "Which one is better?" Another student shared, "I want to get into accelerated really badly next year and then maybe even take a summer class so I can catch up to the kids who are in accelerated right now." Another student said, "I feel like I'm good at math, but then I'm not sure because I'm in a different class than all the other kids."

The quality of some course placement assessments and the lack of multiple measures raise concerns about the placement process.

The LinkIt Form C Assessments and the Pre-Algebra, Algebra I, and Algebra II Readiness Assessments are supported by test blueprints demonstrating alignment between standards and test items. They do not include the Standards for Mathematical Practice, which would provide valuable information for determining students' ability to reason mathematically. Both assessments vary in thinking demand, with the 5th and 6th grade LinkIt Form C containing predominantly Depth of Knowledge Level 1 questions. Low-level questions limit the assessment's ability to report on mathematical reasoning and students' ability to apply mathematical understanding to complex problems. Test blueprints were not provided for the additional assessments, which means it is difficult to determine threats to validity.

The placement process attempts to use multiple measures by including the New Jersey Markers for Success Rubric and the additional assessments. However, teachers' ability to accurately report on students' understanding of grade-level skills is hampered by the lack of a unified written curriculum document. While the additional assessments were not reviewed for this report, they are intended to integrate student performance during the school year as part of the placement process.

The assessments used for the placement process do not align with the assessments valued by teachers, formative assessments (85%), and performance tasks (84%). Teachers are also using formative assessments (90%) along with multiple-choice tests (76%) for grading and reporting purposes. Caregivers and students reported that they use formative assessments, homework, and classwork to monitor student progress in mathematics. The practice of using formative assessments for grading and reporting does not align with their intended purpose. The use of formative assessments in this way may contribute to the disconnect expressed by many caregivers and students between their achievement in courses, and their placement.

Excellent Education Recommendations

1. Revise curricula at all levels so teachers have a reliable guide for classroom instruction that has been intentionally designed for the unique mathematics program in Princeton Public Schools.

2. Revise the course placement system to ensure students are appropriately placed in middle school courses.

3. Strengthen the mathematics assessment system to clearly communicate student progress and achievement.

4. Create vertical teams to design a unified mathematics curriculum and foster collective accountability toward ensuring students' academic achievement.

Revise curricula at all levels so teachers have a reliable guide for classroom instruction that has been intentionally designed for the unique mathematics program in Princeton Public Schools.

The elementary school curricula need to be revised to explicitly address the underlying principles of the New Jersey State Standards. Additional adjustments must be made to the elementary curricula to emphasize learning objectives and corresponding lessons that build students' algebraic thinking. Algebraic thinking is the nature of the thinking that is basic to algebra but also related to the conceptual areas within elementary mathematics (NCTM, 2014). Building a solid mathematical foundation at the elementary school is necessary to ensure all students have equitable opportunities for high levels of mathematics at the secondary level.

Standards for middle school courses Pre-Algebra Accelerated, Algebra I Part 1, and Algebra I Part 2 need to be reorganized to maximize the use of learning progressions. This will allow teachers to use time more effectively in the classroom. The courses should be renamed to minimize confusion and describe course content and assessment more accurately. Pre-Algebra should mainly focus on 6th grade standards and essential 7th grade standards, culminating in the New Jersey State Learning Assessment in 6th grade. Algebra I Part I should focus mainly on 7th grade standards and priority 8th grade standards, concluding with the 7th grade New Jersey Learning Standards Assessment. The Algebra I Part 2 would be replaced with the Algebra I course.

The New Jersey Math Prerequisite Standards and Skills document can guide how to appropriately organize standards from multiple grade levels across domains, clusters, and standards to build coherence. Doing so will help students form connections among conceptual ideas in mathematics and develop their depth of understanding.

> "Depth of understanding is something that students develop over time through sustained experiences that continually emphasize connections and reinforce concepts. Depth of understanding does not happen in one lesson or through a series of lessons" (NCTM, 2014).

Specific revisions to curricula can be found in Sub-Report 1.

As students gain a deeper understanding of mathematical concepts, they will see themselves as capable learners and develop a positive mathematical mindset. As noted in *Catalyzing Change for Middle School Mathematics*, "The relationship between learning and identity is bidirectional, with learning supporting a student's identity and a student's identity supporting their learning" (NCTM, 2020).

Changes in curricula will only impact teaching and learning if they are integrated into professional learning opportunities and regularly used by educators to make instructional decisions. In addition, the curriculum must be used to anchor decisions related to other school systems, such as the assessment and grading and reporting systems.

Revise the course placement system to ensure students are appropriately placed in middle school courses.

It is the expressed desire of the stakeholders of Princeton Public Schools to offer advanced courses at the middle school with the goal of all students completing Algebra l by 8th grade. It is important to note that this approach to middle school mathematics differs from the recommendations by educational mathematics organizations. Both the National Council for Teachers of Mathematics and NCSM: Leadership in Mathematics Education have explicitly called for a common course pathway through middle school.

Findings from educational research should guide the revision of the placement process to ensure it does not undermine student success. Specific revisions have been outlined in Sub-Report 1. They include ensuring strong alignment to grade-level and course content standards and the standards for mathematical practice, revising the Markers for Success Rubric to include specific concepts, skills, and mathematical practices, and replacing the additional assessment method to include performance tasks.

Strengthen the mathematics assessment system to clearly communicate student progress and achievement.

Changes to the mathematics assessment system would give all students, teachers, and caregivers a more detailed and precise understanding of students' progress throughout the year. An improved assessment system would lead to a better understanding of course placement assessment results.

Improvements include using more diversified assessment measures such as performance tasks and projects and increasing the validity and reliability of all summative assessments by developing test blueprints. Incorporating performance tasks and projects alongside traditional assessments provides a broader and more holistic view of student capabilities. Blueprints will ensure that assessments align closely with learning objectives and standards, offering a more accurate representation of student understanding.

In addition, there must be clear communication regarding the purpose and role of different types of assessments—diagnostic, formative, and summative. This clarity will help all stakeholders understand how these assessments contribute to grading and reporting processes. A revised assessment system will be more comprehensive, reliable, and transparent, and will enhance understanding of the placement process.

Create vertical teams to design a unified mathematics curriculum and foster collective accountability toward ensuring students' academic achievement.

Elementary, middle, and high school teachers need to articulate and vertically align standards for middle school courses. It is not the sole responsibility of middle school teachers to ensure student success in compacted courses with multigrade-level standards. Cross-grade-level teams would equip all teachers with the tools, knowledge, and support to provide all students with high-quality mathematics instruction and a more coherent learning experience.

"Mathematical coherence occurs when concepts are connected within and across grades while incorporating attention to mathematical processes and practices. That students see how the mathematics they are currently learning builds on their prior knowledge is important. Making coherence explicit becomes the Velcro®—that is, how the content sticks together—connecting concepts to move student understanding forward" (NCTM, 2014).

Effective Teaching and Learning

Teaching has many aspects, including content knowledge, instructional practices, and the student-teacher relationship. Overwhelmingly, stakeholders agreed that the teacher significantly impacts student learning in either a positive or negative way. Caregivers and students shared many positive experiences with specific teachers. Similarly, the Princeton Public Schools teachers' comments and actions demonstrate that they care deeply about their students and the quality of their mathematics education. While the student-teacher relationship plays a crucial role, with an effect size of 0.72, this analysis focuses on teaching and learning practices (Hattie et al., 2017).

Caregivers were asked to share their insights about the mathematics program. Thirty-five percent of the caregivers reported that teachers were the most effective aspect of the program, while 28% believed that quality teachers would improve the program. When asked to share additional insights about the program, 26% reiterated teachers' impact on a students' mathematics education.

Effective teaching and learning practices exist throughout the district. However, they need to be more consistent. As a result, the overall mathematical experience of students within the district could be more balanced and less dependent on the teacher. This discrepancy in teaching quality leads to the wide range of satisfaction levels expressed by caregivers and students. While some students may excel with certain teachers, others may need more effective instructional methods. Disparities in educational experiences lead caregivers to seek outside support to supplement their children's education.

Detailed findings, conclusions, and recommendations on effective teaching and learning strategies can be found in Sub-Report 2. The information in this section focuses on the relationship between curriculum and instructional decisions, and the impact of teaching and learning practices on access to equitable learning experiences.

Areas of Strength

Quality, student-centered instruction exists in Princeton Public Schools. Students can be observed working collaboratively, engaging in mathematical discourse, and using mathematical tools and representations. Teachers bring attention to mathematical vocabulary and ask students questions about their problem-solving strategies. Many caregivers and students have had positive experiences with their teachers.

Areas in Need of Improvement

1. Effective, research-based teaching and learning practices are not consistently utilized across classrooms.
2. The current approach to instructing mathematics places a heavy emphasis on the teacher's role, resulting in limited opportunities for students to actively participate and engage in the learning process.
3. Equity-focused teaching and learning strategies are not widely integrated into standard classroom approaches.
4. Differentiated instruction does not sufficiently address the learning needs of students.
5. Discrepancies in educational experiences lead caregivers to seek additional support from external resources.

Overarching Recommendation

To enhance the quality of teaching in all classrooms, it is recommended that teachers receive adequate support through opportunities to collaborate with one another to cultivate research-based practices including student-centered learning activities and equity-focused instruction. Of primary importance is the need to develop differentiated instructional practices to address the wide range of learners that teachers have in their classrooms.

Effective, research-based teaching and learning practices are not consistently utilized across classrooms.

During the classroom visits, it was noted that quality teaching and learning are occurring throughout the district. Model classrooms were observed, where students were actively engaged in their learning, working collaboratively and individually, working with appropriate tools and resources, and reflecting on their learning. Effective instructional practices were observed in the classrooms. Students, primarily at the elementary level, used different small group structures, including centers or stations, to work together and share their thinking (see Sub-Report 2 for the specific practices observed).

However, discrepancies exist between research-based teaching and learning practices and the student experience in the classroom, leading to the conclusion that effective practices could be more consistent across classrooms. Teachers reported that they used research-based strategies more often than what was noticed during the classroom visits. When students were asked about the same teaching and learning strategies, some practices identified by teachers were not reported as routine by students. This indicates that even though teachers may be using effective teaching strategies, they are ineffective learning strategies for students. Students need to know how to use these strategies to learn effectively.

The current approach to instructing mathematics places a heavy emphasis on the teacher's role, resulting in limited opportunities for students to actively participate and engage in the learning process.

The main structures reported by teachers for instruction were mini-lessons (96%), direct instruction (92%), whole group instruction (90%), and individual practice (90%) (see Sub-Report 2). The findings reported by students were similar. Students at all levels indicated that the majority of classroom time is dedicated to working through standard problem sets (67%), with comparatively fewer opportunities for engaging in hands-on manipulatives (49%) or applying mathematical concepts to real-world scenarios (39%).

This traditional approach suggests that the mathematics learning environment heavily favors procedural fluency over conceptual understanding and does not sufficiently encourage students to explore the subject matter deeply.

> Effective teaching and learning "engages students in meaningful learning through individual and collective experiences that promote their ability to make sense of mathematical ideas and reason mathematically" (NCTM, 2014).

Classroom visits supported survey responses. Students were observed using active learning strategies, primarily in the elementary schools. However, in most classrooms, engagement was directed by the teacher. Teachers were observed providing verbal feedback to students (86%) and asking questions of students (82%). Students were not observed engaging with feedback or asking questions of the teacher or each other routinely. When students were seated in small group structures, engagement with their peers was predominately to share an answer or process rather than engaging in deep mathematical discourse.

"Practicing problems" emerged as an essential instructional strategy for all stakeholders, which may limit opportunities for more robust approaches to teaching and learning.

Practicing problems typically involves replicating the steps to solve standard, routine problems, which can reinforce procedural skills. Educators (65%), students (67%), and caregivers (77%) identified this as an important instructional practice. However, educational research has noted that practicing problems does not encourage students to create solutions for more complex, nonroutine mathematical challenges.

Both caregivers and students seem to place less importance on the application of mathematical practices that are crucial for a deeper understanding of the subject. These practices include engaging in classroom discussions that foster mathematical reasoning, as well as utilizing various mathematical representations and tools to comprehend and solve problems. Embracing these practices more fully could shift the focus from rote learning to a more comprehensive, inquiry-based approach that develops both procedural fluency and conceptual understanding.

Equity-focused teaching and learning strategies are not widely integrated into standard classroom approaches.

Equity-focused teaching strategies in mathematics include connecting math to the real world, including students' experiences and interests, and drawing on various funds of knowledge. Educators did not widely recognize the importance of these opportunities or implement them in practice. Greater emphasis on these strategies could potentially lead to more equitable educational outcomes by allowing all students to connect with and understand mathematical concepts within the context of their own cultural and experiential backgrounds.

Also noticeably missing as a routine practice from educators, caregivers, and student surveys was the importance of the intentional development of students' mathematical mindset. A positive mathematical identity is especially necessary for an educational environment emphasizing excellence and acceleration. When students develop a positive mathematical disposition, they are better equipped to pursue more challenging mathematical courses that go beyond those courses that are required for graduation (see the Equity and Access Findings, Conclusions, and Recommendations for more information).

Differentiated instruction does not sufficiently address the learning needs of students.

Despite 80% of educators acknowledging that they differentiate instruction, a significant gap exists in what was reported by students. Only 34% of students at the elementary level, 28% at middle school, and 35% at high school feel that the math tasks are personalized to their learning needs. In addition, classroom visits indicated classrooms were not conducive to differentiation due to spacing issues. Many caregivers and students reported the use of computer-based programs as an inadequate solution for differentiation and addressing student learning needs. Teachers recognize the need to improve this practice with 49% of teachers seeking further training in differentiation.

Caregivers and students expressed that student learning needs are not being met and, therefore, they seek additional support from external resources.

According to open-ended responses from caregivers, many feel that the current mathematics program is not adequately meeting the needs of their children. Some of the reasons cited include dissatisfaction with the teacher, limited access to advanced courses, lack of student support, and dissatisfaction with the available resources. As a result, 63% of caregivers report that their children receive additional support outside of school, with 24% opting for outside assistance and 39% providing it themselves if possible.

In addition to caregivers, students also reported using outside support to address their learning needs, with 37% receiving assistance from family members or caregivers, 14% working with a tutor, and 10% taking a class outside of school. These figures, as outlined in Sub-Report 2, suggest that students may feel that their learning needs are not being fully met within the classroom.

> "I think there is a lot of talk in the district about tutoring and whether that is a good thing or a bad thing. And I think what this survey, and those conversations, miss out on is that there are different reasons that someone might go to a tutor. In some cases, people take their kids to tutors because they struggle with the classwork and need extra support. I would hope that all students would have access to support if they are struggling—and, of course, that class standards are realistic. This seems like the problem that the district may be trying to fix. But in other cases, some kids go to a tutor or outside math teacher/class/etc. because they really *enjoy* math! And they want more math than the school is providing or at a level of challenge that the school is not providing. This seems like a very different thing, and not necessarily something bad that we want to get rid of (in fact, maybe we want to provide after-school math clubs with scholarships available to provide more of this type of enrichment!). If a child loves soccer and plays on both the school-run soccer team and PFC or one of the privately run soccer teams, we are not trying to get the child to quit PFC. Kids have passions, and sometimes they are academic. Maybe future discussions, communications, and this math review can take a more nuanced look at what type of tutors and why children work with them. Thank you for your consideration! *Princeton Public School Caregiver*"

Learning Strategy	Teachers*	Students**	Caregivers***	Noticed in classroom visits
Engage in mathematical discussions	49%	43%	65.8%	55%
Communicate mathematical reasoning	86%	35%	n/a	Student responses to questions 86% level 1 82% level 2 36% level 3
Use mathematical practices, including math tools and visual representations	78%	49%	40%	59%
Work independently	80%	52%	46%	100%
Work collaboratively with a partner or in small groups	65%	57%	48%	55%
Solve problem sets to develop procedural fluency	65%	67%	77%	64%
Engage in activities that promote a growth mindset and mathematical identity	65%	48%	n/a	Visible reflection 55% Related displays 32%

Teaching Strategy	Teachers	Students	Noticed in classroom visits
Bring attention to mathematics vocabulary	86%	63%	68%
Use probing questions to promote reasoning and problem-solving	88%	55%	82% level 1 77% level 2 27% level 3
Communicate the goal of the lesson in a language students can use and understand	92%	57%	46%
Provide students with feedback	86%	43%	86% verbal 9% written
Use mathematical representations	82%	58%	n/a
Differentiate learning activities	80%	32%	n/a
Make connections between math concepts and real-world situations	71%	39%	n/a
Personalize tasks based on student interests and experiences	43%	34%	n/a

* Percentages of teachers who responded frequently (every day) and always (3-4 times a day)
** Percentages of students from elementary, middle, and high school
*** Caregivers were asked which strategies or methods help their child learn mathematics.

Teaching and Learning Recommendations

1. Develop a strong written curriculum to guide instructional decisions.

2. Support teachers through professional learning focused on research-based and equity-focused instructional practices.

3. Address student learning needs in multiple ways to ensure the development of strong mathematical identities.

1 Curriculum

Develop a strong written curriculum to guide instructional decisions.

Effective teaching and learning begins with articulated written curricula. The type of curricula significantly influences instructional practices adopted by teachers and the assessments used to gauge student learning. To fully achieve the goal of providing all students with inclusive and supportive learning experiences, all students must access effective teaching and learning practices regardless of classroom.

Support teachers through professional learning focused on research-based and equity-focused instructional practices.

Research-Based and Equity- Focused Practices 2

To enhance the quality of teaching in all classrooms, it is recommended that teachers collaborate with one another to cultivate the Mathematics Teaching and Learning Practices recommended by the National Council for Teachers of Mathematics. These best practices involve fostering student discourse (justification, sharing of thoughts, and logical reasoning), leveraging visual and other representations, and tailoring the mathematical curriculum to resonate with students' real-life experiences (NCTM, 2020). They require that students understand learning objectives and actively monitor their progress toward these outcomes.

Ensuring the relevance of mathematics in a student's daily life is a critical component of an equitable instructional approach. Some examples of such strategies and tasks include performance tasks, inquiry-based instruction, and project-based learning experiences. Engaging students in real-life problems centered on their interests or community issues enriches the subject's meaning and relevance.

Ensuring continuous improvement in the teaching practice of all educators is critical for promoting research-based instructional methods and enhancing student learning outcomes. Professional learning programs for teachers should be tailored to meet the diverse needs, strengths, and experiences of educators. However, it is essential that all professional development efforts align with the New Jersey Learning Standards for Mathematics, provide opportunities for practical application, and include the evaluation of student work to determine the impact and improve the quality of instruction. Princeton Public Schools must provide comprehensive support to teachers through effective professional learning, systems, and structures that maximize teacher time and prioritize student learning outcomes.

Address student learning needs in multiple ways to ensure the development of strong mathematical identities.

Achieving successful learning outcomes depends on implementing equitable, differentiated instruction. Equitable differentiated instruction requires "that teachers take direct action stemming from careful and intentional planning and reflection informed by data from their students" (NCTM, 2020).

Based on Hattie's meta-analysis, the effect size for ability grouping is 0.12 compared to the impact of small group instruction with flexible grouping based on student need, with an effect size of 0.49.

It is imperative that teachers continuously use diagnostic and formative assessments to create fluid, small groups, intermixed with heterogeneous groups where students learn from each other and avoid in-class ability tracking.

When students' learning needs are unmet, their mathematical identities can suffer. Both support for students who need additional time and those who need more challenge must be considered when differentiating instruction in class. Guidance and support from special education teachers, gifted and talented teachers, teachers of multilingual learners, and mathematics coaches can assist teachers in developing these strategies.

Students must have opportunities to explore and apply mathematics both during school, as well as through after-school clubs and experiences. These opportunities at the elementary and middle school should connect with computer science standards to generate more interest in high school computer science courses from a wider range of diverse students currently underrepresented in the program.

Making systemic changes to the mathematics program can lead to a satisfying mathematics experience and positive learning outcomes for all students. A clear, articulated curriculum designed specifically for Princeton Public Schools mathematics program, along with effective research-based teaching and learning strategies and data-driven differentiated instruction, can decrease the need for additional support that caregivers and students expressed.

Equity and Access

The goal of an equitable mathematics program is to provide all students with access to high levels of mathematics that meet their learning needs, whether that requires extra time to develop conceptual understandings or extensions of learning. Ultimately, an equitable mathematics program strives to increase participation across diverse racial, ethnic, gender, and socioeconomic groups, aiming to elevate the number of students who reach the highest levels of mathematical proficiency.

While it may seem that all students can enter advanced coursework through the course placement process, a common process does not guarantee equitable access. A mathematics program that strives to provide equitable access to high-level mathematics encompasses various essential components, all geared toward ensuring fair access to high-quality mathematics education. These components include a well-designed curriculum and the implementation of effective teaching and learning practices.

The preceding sections explained how curricula and teaching and learning practices can be harnessed to offer equitable opportunities for students. This section delves further into the impact of curricula and teaching and learning practices and explores additional factors that contribute to students' access to high-level mathematics and advanced mathematics. Detailed findings, conclusions, and recommendations on student access to equitable pathways for achieving high-level mathematics can be found in Sub-Report 3.

Areas of Strength

Princeton Public Schools has a variety of programs and structures available to students of all learning needs, including those who need more time and support and those who need extensions and challenges. Student learning needs are addressed through Individual Education Programs, the QUEST Multi-Tiered System of Support, and advanced course offerings in mathematics at middle and high school. In-school support is available during FOCUS, PAWS, and Tiger Time. The Plus class in high school and the new support class in middle school are "stacked or corequisite mathematics classes" that provide students with additional periods of instruction. The Dual Language Immersion Program at Community Park Elementary School provides instruction in mathematics in Spanish.

Areas in Need of Improvement

1. Black and Hispanic students, students who receive free and reduced lunch, students who receive special education services, and multilingual learners are consistently underrepresented in middle and high school advanced courses.
2. Educators, caregivers, and students hold differing opinions as to whether all students have access to high expectations.
3. Practices that support equitable access, such as equity-focused instructional practices and differentiated instruction, should be used more effectively.
4. Support structures exist but do not adequately address the needs of all learners.
5. Students need a strong mathematical identity and agency to pursue advanced courses when ready.

Overarching Recommendation

To ensure every student has an equal opportunity to excel in mathematics, Princeton Public Schools needs to improve and align its existing systems. This entails creating a comprehensive and unified curriculum and enhancing teaching and learning practices. It requires building a support system that caters to the unique needs of every student and nurturing students' mathematical identities so that they acquire the motivation and self-determination to pursue advanced mathematics courses when the time is right. A common understanding of the factors that lead to inequitable learning situations is necessary to take the actions required to address these disparities effectively.

Black and Hispanic students, students who receive free and reduced lunch, students who receive special education services, and multilingual learners are consistently underrepresented in middle and high school advanced courses.

Course enrollment in advanced courses at the middle and high school levels does not reflect the diversity of the student population based on race and ethnicity, language, free and reduced lunch eligibility, and students who receive special education services. Course enrollment demonstrates that Black and Hispanic students represent a larger proportion of students enrolled in special education mathematics courses. Students who receive free and reduced lunch, multilingual learners, or student who receive special education services do not enroll in advanced courses at the high school level (see Sub-Report 3).

Educators, caregivers, and students hold differing opinions as to whether all students have access to high expectations.

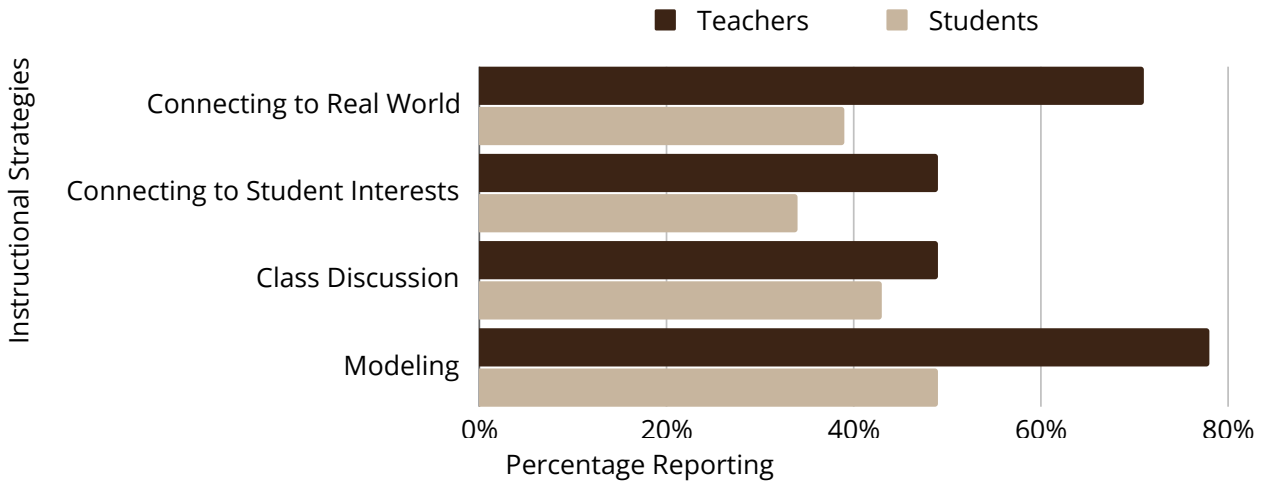
While educators (72% agree/strongly agree) responded that they felt all students had access to high expectations, caregivers did not hold this opinion (43% agree/strongly agree). While students were not explicitly asked whether they felt they had access to high expectations, a group of multilingual learners shared their experience as newcomers in the district during a focus group session that warrants examination. All of the students (6) shared similar sentiments. They reported that initially, teachers made assumptions about their knowledge. When students worked with a teacher who provided them with high-quality instruction and held them to high expectations, they were able to achieve. One student shared, “Last year at PHS, I was learning something I already knew (adding, subtracting, etc.). I was not happy because I knew it already. The change is unbelievable because it’s Algebra now, and I am very happy.” Another student shared, “This year has been very good because of the bilingual teacher. She teaches in a way that we understand, and now I can do all my Algebra work.” All but one of the students shared that they would continue to take math classes after they completed the required math courses.

The expectations set in the classroom can also be gauged by the nature of tasks and activities assigned to students. As indicated in the Effective Teaching and Learning section, stakeholders identified practicing problems as a common instructional practice. However, practicing problems is an indicator of using mathematics in routine, predictable ways while solving challenging problems is usually associated with the use of mathematical reasoning and high expectations. Overall, 43% of students (see Sub-Report 2) reported solving challenging problems as a learning strategy, indicating that they may not be expected to do so on a regular basis.

Practices that support equitable access, such as equity-focused instructional practices and differentiated instruction, should be used more effectively.

As discussed in the Teaching and Learning section, equity-focused teaching strategies in mathematics include connecting math to the real world, including students' experiences and interests, and drawing on various funds of knowledge. However, these practices are not widely implemented, with only 49% of teachers reporting daily integration of students' lives and experiences. Furthermore, students perceive these strategies to be even less utilized, with 39% noting their teachers connect math to real-world contexts and 34% to student interests. These figures suggest a gap between the teacher perception and student experience, as shown below.

Comparison of Teacher vs. Student Reported Use of Instructional Strategies



Additionally, active learning strategies that benefit underrepresented students in advanced classes are not commonly used, according to both teacher and student surveys. For instance, daily class discussions are reported by 49% of teachers but recognized by only 43% of students. The use of real-world applications, or contextualization, is claimed to be used daily by 71% of teachers, yet only 39% of students report experiencing this. Modeling, an essential standard for mathematical practice, is reported as a daily activity by 78% of teachers compared to 49% reported by students. These disparities are also explained in Sub-Report 2.

Most teachers reported that they differentiate instruction in the classroom (80% identified differentiation as an instructional practice, and 89% reported that differentiation is a support structure in place so every child reaches high levels of mathematics). However, as discussed in the Teaching and Learning section, students and caregivers report that learning needs are not being met within the classroom setting and that differentiation is not effective.

Support structures exist but do not adequately address the needs of all learners.

Support structures are available through Individual Education Programs, the QUEST Multi-Tiered System of Support, and advanced course offerings in mathematics at the middle and high school.

In-school support is available during FOCUS, PAWS, and Tiger Time but is optional and dependent on student initiative. Plus classes are also available at the high school but are underutilized and also optional, with only 20 students taking advantage of these classes. The Dual Language Immersion Program at Community Park Elementary School provides instruction in mathematics in Spanish. The Dual Language Program exists at the middle school but does not apply to mathematics.

5 Students need a strong mathematical identity and agency to pursue advanced courses when ready.

Once students are placed in a pathway in 7th grade, moving from that trajectory is difficult. Since all students complete Algebra I upon leaving middle school, it is possible to graduate having completed Calculus in 12th grade. Students can take summer advancement courses or two high school courses simultaneously to advance. The amount of students interested in these courses far exceeds the availability. In addition, potential problems with this approach include family or work obligations and a lack of communication with those who may benefit from these courses.

For some students, a bigger obstacle is that they do not have the desire or agency to pursue advanced courses. Students who are not in the accelerated pathway in middle school (students who are in the Pre-Algebra, Algebra l Part 1, Algebra 1 Part 2 pathway) or those who find math difficult may not continue on to complete Calculus or use the options to advance further in mathematics. The following chart demonstrates this point. Students in Algebra 1 Part 2 reported the courses they hope to take in high school.

Course	**N 74**	**%**
Geometry	65	88%
Algebra ll	50	68%
Pre-Calculus	31	42%
Calculus	21	28%
Intro to Statistics, Data Analysis, and Probability	10	14%
AP Statistics	10	14%
AP Calculus AB	8	11%
AP Calculus BC	8	11%

When middle school students were asked what they do when mathematics becomes difficult, 50% skipped the problem, and 69% asked for help, demonstrating a lack of perseverance. Some students also expressed feelings of frustration or hopelessness, stating that when math gets difficult, they “cry, give up, I get upset and think this is pointless and I don’t care, and this is dumb, stop doing math, quit.”

Equity and Access Recommendations

1. Make adjustments to curricula to ensure all students develop a strong foundation in mathematics.
2. Strengthen teaching and learning practices by incorporating equity-focused instructional practices into all classes, including support classes.
3. Leverage current support structures and create new mechanisms so all students' learning needs are met.
4. Support the development of student mathematical mindset and agency.
5. Provide professional learning opportunities that support all students and increase access for those underrepresented students in advanced and accelerated classes.

"The question is not whether all students can succeed in mathematics, but whether the adults organizing mathematics learning opportunities can alter traditional beliefs and practices to promote success for all" (NCTM, 2024).

Make adjustments to curricula to ensure all students develop a strong foundation in mathematics. These revisions aim to solidify students' mathematical bases and establish a cohesive program, as detailed in Sub-Report 1.

Strengthen teaching and learning practices by incorporating equity-focused instructional practices into all classes, including support classes.

Ensuring the relevance of mathematics in a student's daily life is a critical component of an equitable instructional approach. Engaging students in real-life problems centered on their interests or community issues enriches the subject's meaning and relevance. Incorporating performance tasks, inquiry-led teaching, and project-based learning deepens these experiences.

The guidelines set by the New Jersey Department of Education can be used to select appropriate tasks and learning activities that support diversity, equity, and inclusion. Educators should ask:

- Are the lessons in accordance with the New Jersey Student Learning Standards, and do they promote interdisciplinary connections?
- Do the instructional strategies and resources promote independent learning and ownership of the learning process?
- Do the lessons focus on a compelling, authentic, and engaging problem that inspires students to take action in response to real-world challenges?
- Do the lessons require the activation and incorporation of students' cultural background knowledge to build new knowledge and skills?
- Do the lessons include resources created by authors of diverse backgrounds, as well as include the expertise, contributions, and perspectives of diverse cultures, abilities, and identities?

3 Support Structures

Leverage current support structures and create new mechanisms so all students' learning needs are met.

The recently introduced mathematics support class in middle school and the Plus program in high school align with the NCTM's recommendations for a "stacked or corequisite mathematics class." This approach places students in standard grade-level courses alongside their peers and also provides an extra period for further mathematical assistance and time (NCTM, 2020). While both programs are optional, the middle school automatically enrolls students, giving them an option to decline. The Plus classes in high school require students to enroll. If students do not have a strong mathematical identity or agency, they may not take advantage of these classes. Students would benefit from a similar enrollment approach in Plus, as the one used in middle school.

A more targeted approach is needed to proactively address the needs of multilingual learners. The Dual Language Immersion Program at Community Park Elementary School offers many advantages for multilingual learners. It is crucial for educators and community representatives to actively connect with families to ensure they are informed about this program. Moreover, all educators must employ effective methods and use bilingual resources to support multilingual learners in the classroom.

Improvements to the assessment system are necessary to provide appropriate and timely support for students. LinkIt assessments aligned with grade-level and course standards, in conjunction with classroom formative assessments, can be used to determine starting points for instruction. With this information, teachers can differentiate instruction and provide in-class support for students who have yet to develop conceptual understandings and those who have demonstrated mastery. Special education teachers, QUEST teachers, school counselors, and other support teachers should be involved in these data and planning meeting to assist in identifying strategies to support all students in the classroom.

4 Mathematical Identity

Support the development of student mathematical mindset and agency.

From early in elementary school, students should learn about growth mindset, and teachers should employ strategies that promote the use of growth mindset in overcoming challenges and developing perseverance. These strategies should include tasks that offer multiple entry points and encourage discussion around mathematical reasoning. They should also include engaging students in productive struggle and reflective practice. Supporting growth mindset can help students develop a positive mathematical identity, which can influence their participation in math-related activities, their pursuit of math-related fields, and their overall confidence in tackling mathematical problems.

When students are enrolled in instructional support classes like Plus and the middle school support class, it is important that the teachers of these classes avoid labels that undermine student learning. “One role of mathematics teachers and leaders is to ensure continual affirmation of students’ positive mathematical identities through their learning experiences, feedback, and building on their strengths that will support them in developing resilient, positive identities” (NCTM, 2021).

Data-informed instruction should become routine practice. It should begin with using a wide range of diagnostic and formative assessments clearly tied to learning objectives and progressions. By identifying where students are within these progressions, teachers can help students make connections to prior knowledge. Recognizing students’ current abilities and knowledge fosters an asset-based approach to instruction rather than a deficit approach to learning (Lalor, 2021). These and other asset-based approaches to learning are necessary to support students in developing the mindset to persevere when mathematics is challenging and rely on the conceptual understandings, skills, and strategies they have learned to address new and unfamiliar problems.

Provide professional learning opportunities that support all students and increase access for those underrepresented students in advanced and accelerated classes.

Providing professional learning is necessary for all educators to provide equitable access for all students. In addition, a mathematics program that provides equitable access to high levels of mathematics will ensure that all students engage in high-quality instruction provided by effective teachers. It is imperative that the district avoid the inequitable practice of placing students with inexperienced and ineffective teachers, and that the district provides the support necessary for improving these teachers' practices through mentoring and coaching.

Changes in curricula, the development of equity-focused instructional practices, and the strengthening of support mechanisms are all necessary to improving access to high-quality mathematics. It is crucial, however, that professional learning in these areas include opportunities for reflective practice. Reflective practice is necessary to develop productive beliefs and corresponding systems to support all students in achieving high-level mathematics.

> "Making this principle [Equity and Access] a reality requires all stakeholders to monitor the extent to which all students have access to a challenging mathematics curriculum taught by skilled and effective teachers who know and understand the cultures and communities from which their students come and who also use this knowledge to create meaningful tasks that build on students' prior knowledge and experiences. These teachers also monitor student progress and make needed accommodations. To do this effectively, they work collaboratively with colleagues, including teachers of special education, gifted education, and multilingual learners, as well as families and community members, to ensure that all students have the support they need to maximize their success in the mathematics classroom. Further, teachers need to collaborate with one another to implement mathematics teaching principles and promote a growth mindset in their classrooms and schools" (NCTM, 2014).


NEXT STEPS

Collective Efficacy

Princeton Public Schools is committed to providing all students with an excellent mathematics education, as seen through the many changes in programming that have occurred in response to the evolving needs of students. However, these changes have resulted in inconsistencies and lack of coherence in the mathematics program. In addition, the many changes that have occurred in mathematics in past years may have undermined trust in the system's capability to meet student learning needs.

While some will feel there is a definitive solution that will address student needs, what is beneficial to one student may not be for others. What is foundational for all students to receive the excellent mathematics education they deserve is a community that shares productive beliefs about mathematics education and takes actions in alignment with those beliefs that will benefit all students within the school system.

Collective efficacy is the shared belief or perception among a group of individuals that they can achieve desired goals, overcome challenges, and make a positive impact through their combined efforts. A systemic approach to addressing the recommendations shared in the previous section can support Princeton Public Schools in ensuring that all students benefit from a quality education.

The ADL Team recommends that the district develop a strategic mathematics plan that includes the following actions:

Mission and Vision: Recommit to or revise the program's mission and articulate a vision for mathematics education.

Collaboration: Provide diverse opportunities for all educators to collaborate within and across grade levels, courses, and programs to build a cohesive mathematics program that will be beneficial for all students.

Communication: Develop consistent and transparent communication methods among all stakeholders. These methods should help develop productive beliefs about mathematics education and encourage actions that align with those beliefs, ultimately leading to improved learning outcomes for all students.

These actions incorporate the recommendations made in the sub-reports and the overall recommendations found in the full report. They are intended to be implemented over time to allow the system to maintain quality, adjust to changes, and be the least disruptive to student learning.

Mission and Vision: Recommit to or revise the program's mission and articulate a vision for mathematics education.

A strong vision and mission will serve as a compass for providing all students with an excellent mathematics education that encourages students to achieve at high levels.

Educators, caregivers, and students provided feedback that indicates differing views on the objectives of the mathematics program and what instructional methods should be used in the classroom. These differences include whether teaching should involve direct instruction and skills practice or focus on students actively exploring and constructing knowledge.

The mission and vision can develop a shared understanding of the mathematics program's purpose, align the diverse components of the program, and provide criteria against which new initiatives and overall performance can be measured. Educators can integrate the vision and mission into all communications so the purpose behind the mathematics program decisions is aligned and transparent to all stakeholders.

This process needs to involve members of all schools, including elementary and secondary educators, special education educators, dual language immersion and multilingual learner educators, and other instructional support staff. It is the shared responsibility of all educators to understand the direction and long-term objectives of the mathematics program and work toward achieving its goals.

The Program Evaluation Team that engaged in the review process is a prime example of the positive outcomes of bringing together staff members from various buildings and grade levels who represent diverse students. Conducting collaborative discussions, sharing classroom practices, visiting classrooms, engaging in student focus groups, and reviewing student surveys fostered a common understanding of mathematics teaching and learning across the district. The team explored the district's current mission and began conversations on essential aspects students need as mathematicians. Their efforts have positioned them to guide the review of the mission statement and articulation of the vision statement, which are foundational to the successful implementation of the recommendations.

Collaboration: Provide diverse opportunities for all educators to engage in professional learning and collaborate within and across grade levels, courses, and programs to build a cohesive mathematics program.

While many teachers have participated in professional development related to mathematics, the amount of time and emphasis devoted to mathematics professional learning does not match the importance attributed to mathematics instruction in Princeton Public Schools. The recommendations throughout this report have identified areas of focus for professional learning. They include those expressed by educators, such as student engagement, effective differentiation, and fostering students' growth mindset and mathematical identity. Educators would also benefit from assessment literacy to improve the validity and reliability of all assessments and improve communication of student progress and achievement. Professional learning is necessary to support educators in developing equity-focused instructional strategies to address their students' diverse cultural, social, and learning needs.

In addition to traditional methods of professional development, all educators, regardless of their years of experience or level of expertise, can enhance their practice by engaging as a learning community to deepen their understanding of best practices, collaborate, and exchange instructional strategies. Opportunities for cross-grade-level collaboration benefit students as they progress through a coherent program designed to support them in making connections, building upon prior knowledge and experience, and supporting their ability to think mathematically.

Additional avenues for collaboration include grade-level planning meetings, classroom intervisitations, and routinely engaging with LinkIt and other assessment results during data meetings. Teachers will come to value each other's insights and feedback and see themselves as a learning community working to improve learning outcomes for all students, not just those in their classrooms.

A supportive school culture is essential for this to succeed, where teachers feel supported by the administration and are encouraged to innovate and take pedagogical risks. When teachers are empowered with the necessary tools and resources, they are better equipped to create transformative learning experiences for every student. School leaders play a crucial role in fostering this environment by trusting their teams, seeking feedback, and committing to continuous improvement. By doing so, they signal to educators that their expertise and insights are valued and that their collective efforts can influence student outcomes and drive positive change in the educational environment.

Fostering collaboration and providing diverse learning opportunities for educators are crucial to meeting the needs of all learners. A comprehensive approach ensures all educators are equipped to provide every student in the district with a high-quality education that prepares them for success in their future endeavors.

> "For mathematics educators to collaborate with others is vital to meeting the needs of each and every learner. The collective wisdom of a mathematics team is much greater than a single individual member. Mathematics leaders and teachers must ensure that structures are created for intentional collaboration and must identify policies and other structures that might impede collaboration and the work of teachers. Teachers need dedicated time during their daily schedule to collaborate with their peers who teach the same grade or same course, including special education and multilingual learner educators. To create coherence across grade levels and mathematics course matriculation, teacher teams should collaborate vertically. Working with the teacher teams in grades before or after a specific grade level promotes more effective activation of prior knowledge strategies, more focus on the essential content of each grade, more focus on the academic language and strategies used to develop mathematical rigor, and less repetition of content from year to year. Vertical collaboration will promote identifying content connections between grade levels and between concepts, which in turn will help teacher teams guide their students to understand the same connections" (NCTM, 2020).

Communication: Consistent and transparent communication methods must be developed among all stakeholders to build productive beliefs about mathematics education and encourage actions that align with those beliefs.

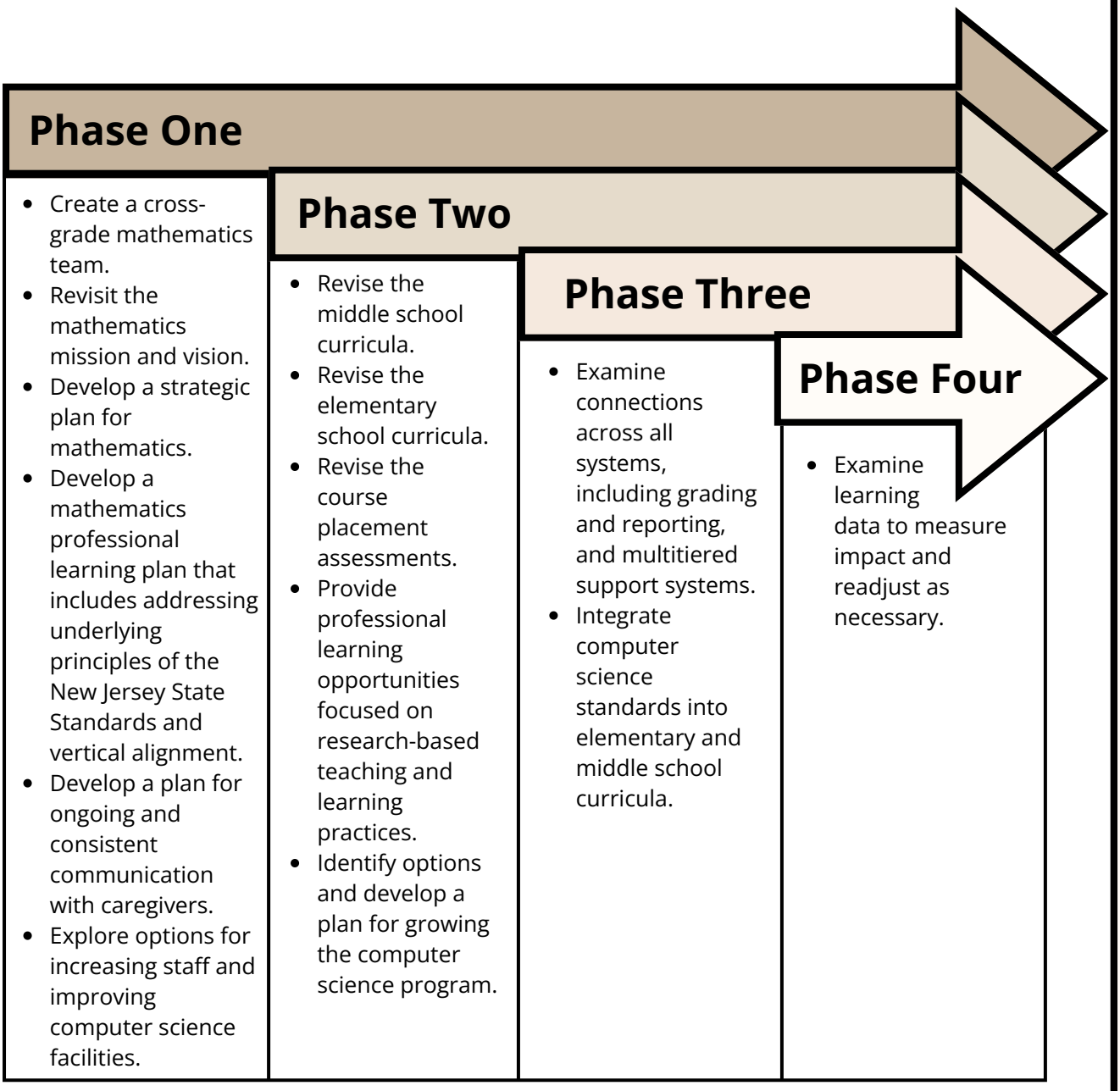
Communication with caregivers must be improved to build trust that the mathematics program will meet the needs of their children. Through open-ended responses and focus groups, caregivers consistently emphasized the need for increased information about curriculum, courses, and their children's progress and achievements across all educational levels.

Princeton Public Schools has taken measures to address these needs and concerns. District administrators have initiated efforts to share pertinent information with caregivers, including presentations on elementary school curriculum and middle school math placement. These initiatives are ongoing, with additional presentations planned. Integrating ongoing communication about programs, student progress, and achievement on a routine basis is crucial to rectifying misinformation and misunderstandings.

Equally important is communication between educators and students. Effective communication with students can enhance students' ability to self-regulate and take ownership of their own learning. Clear articulation of learning objectives and timely feedback to students as they progress toward these targets can significantly enhance student learning. Ongoing communication with students about their learning in a way that they can use and understand empowers students, fosters resilience and adaptability in the face of challenges, and nurtures the development of a growth mindset.

Strengthening continuous dialogue and collaborative efforts among educators is essential for improving communication not only within the school system but also with caregivers and students. Effective communication from school leaders to teachers often translates into clearer and more informative communication with caregivers. Communication with educators across different grade levels and school buildings creates a more cohesive learning experience for students. When the channels of communication are open, they play a central role in developing the shared responsibility for the success of all students.

The ADL Team suggests that the recommendations from this report be implemented in phases to ensure the development of a cohesive and sustainable mathematics program. The following diagram offers an approach for addressing recommendations and next steps.



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