Balancing Equity and Excellence: Lessons from Finland, Singapore, and Germany for NYC STEM Reform

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Abstract

I offer a sustainable pathway for New York City to build a more inclusive and innovative STEM education system through a three-part strategy that draws on international best practices. Currently, New York City education policy needs reform as systemic inequities in access to rigorous coursework reinforce patterns of segregation and narrow the city's STEM talent pipeline. I then provide recommendations to reform New York City's high school admissions system, develop inclusive STEM magnet programs, and implement a STEM-specific needs-based funding formula by using aspects from the international models of Finland, Singapore, and Germany. After providing evidence-based recommendations, I identify key barriers to reform and outline concrete strategies for overcoming them through stakeholder engagement, outlining funding sources, and providing an equity-focused rationale for reform to the established education system.

The Problem with Current NYC Education

The patterns of racial and socioeconomic segregation persisting in New York City's high school admissions have sharply limited equitable access to high-quality STEM education. These inequities are most visible in the admissions outcomes for the city's eight specialized high schools, which serve as gateways to elite colleges, internships, and STEM career pipelines. According to a July 2025 report in The New York Times, just 8 of the 781 incoming students at Stuyvesant High School, the most prestigious school of the specialized schools, were Black, and only 27 were Hispanic. In contrast, 509 seats went to Asian students, and 142 to white students (Closson, 2025).

However, this disparity is not unique to Stuyvesant, as the Bronx High School of Science made 21 offers to Black students and 55 offers to Hispanic students out of 738 admissions offers. What is startling about the offer numbers is that Black and Latino students comprised over 44% of all test-takers, but they received only 10% of the offers. Meanwhile, the city's public school population is 42% Hispanic and 20% Black. Such stark underrepresentation in the city's specialized schools, despite relatively proportional participation in the admissions process, points to structural inequities as the culprit rather than interest in specialized education.

Admission to any of New York City's eight specialized high schools is based on a standardized exam called the Specialized High School Admissions Test (SHSAT). From my experience as an educator, many students begin preparing for the SHSAT in 6th grade, and families spend resources to best prepare their children for the exam. Access to such preparation is inequitable as families with higher incomes can afford private tutoring and test-prep programs, while lower-income families often lack these resources. The SHSAT has become a proxy for privilege rather than a neutral measure of merit, as performance on admissions exams like the SHSAT is strongly correlated with parental education level and socioeconomic status, making the test (Civil Rights Project, 2021). Former Mayor Bill de Blasio attempted to address these concerns by proposing to replace the SHSAT with an admissions process based on middle school class rank in 2018. Even though this change to admissions was projected to significantly increase Black and Latino enrollment at the specialized high schools, the proposal faced intense political pushback and was ultimately rejected (Shapiro, 2019).

The continuation of the SHSAT and the broader use of academic screens in non-specialized high schools sustains a bifurcated system, determined by socioeconomic class. A small cluster of elite, screened schools hoards resources, advanced coursework, experienced teachers, and reputational value, while the vast majority of schools contend with under-enrollment, limited access to advanced STEM courses, and staffing shortages. This two-tiered structure mirrors and reinforces New York City's extreme school segregation.

Based on the Civil Rights Project report in 2021, 94% of NYC students attended predominantly nonwhite schools, and 70% attended intensely segregated schools. Black and

Latino students were especially isolated, with 85% and 75% respectively attending intensely segregated schools, compared to only 11% of white students and 43% of Asian students. These inequities are compounded by concentrated poverty. In 2018, 73% of all NYC public school students were economically disadvantaged, but Black and Latino students disproportionately attended schools where over three-quarters of students were low-income. Such schools faced multiple challenges, including higher rates of teacher turnover, fewer enrichment opportunities, and lower access to advanced coursework, which further depress student outcomes. Thus, when specialized high schools have racial demographics that show that 82% of students are white or Asian, and 15% of students are Black and Latino, despite representing over two-thirds of the city's public school population, it becomes clear that access to high-quality information, test preparation, and transportation is unevenly distributed across racial and socioeconomic lines. Without systemic reform, the SHSAT and academic screening will continue to be structural barriers that exclude talented students from marginalized backgrounds.

Since the specialized schools only serve about 5% of NYC's high school population, they disproportionately shape access to elite colleges, internships, and STEM career pipelines. Admission to these schools provides access to higher-level STEM coursework, specialized enrichment programs, and experienced faculty that shape students' long-term trajectories. Courses such as AP Calculus, AP Physics, AP Computer Science, and engineering electives are offered regularly in these schools, yet they are often unavailable or inconsistently offered in neighborhood high schools, particularly in underserved districts.

Research has shown that early access to rigorous STEM coursework significantly increases the likelihood of entering and completing a postsecondary STEM degree (Wang & Degol, 2013). Conversely, students without these preparatory experiences are far less likely to pursue STEM fields, regardless of talent. By failing to cultivate STEM talent equitably across its public school system, NYC is underutilizing the intellectual capital of entire communities. When whole communities are denied access to high-quality STEM education, the city loses the diverse perspectives, innovations, and talents they bring.

Additionally, students of color who are systematically shut out of opportunity receive a message, either explicit or implicit, that STEM is not for them. This undermines identity development, self-efficacy, and long-term engagement in science, technology, and mathematics. As the city grapples with chronic absenteeism, post-pandemic academic slide, and youth mental health crises, the absence of inclusive spaces of excellence further entrenches disengagement and cycles of disinvestment.The political climate compounds the urgency. Integration has faded from the city's education agenda. Mayor Eric Adams, who once criticized the SHSAT as a form of 'Jim Crow, ' has not prioritized admissions reform. The most recent admissions data showed declining offers to Black and Hispanic students at specialized high schools, yet it was released without comment or explanation from the administration (Closson, 2025).

Without structural reform, NYC will continue to operate a system in which STEM opportunity is predetermined by neighborhood and resources, rather than talent and potential. The cost is not only moral, but economic, squandering the city's diverse intellectual capital and weakening its position as a 21st-century innovation hub.

Modeling Reform after International Successes

A reimagined system grounded in inclusive magnet schools, reformed admissions policies, and targeted investment can begin to dismantle entrenched inequities and fulfill the promise of fair public education in a 21st-century city. After looking at comparisons to international education systems, it is possible to balance excellence with equity by designing education systems that build strong foundational skills, expand early access to STEM content, and delay academic tracking. For example, Singapore is consistently among the top-performing nations on the Programme for International Student Assessment (PISA). In the 2018 assessment, Singapore ranked second globally in mathematics and second in science, far outperforming the United States, which ranked 37th in math and 18th in science (OECD, 2019). What is most notable about Singapore's performance is its relatively narrow distribution of outcomes. Disadvantaged students in Singapore not only outperform their peers across OECD countries but also exceed the OECD average in mathematics and science achievement. In fact, about 10% of disadvantaged students in Singapore score in the top quarter of mathematics performance (OECD, 2024). This success reflects Singapore's inclusive and systematic approach to education as the country uses a tiered system of enrichment and academic supports beginning in primary school. Differentiated instruction and targeted talent development are embedded across the system, which enables students with diverse needs and starting points to access rigorous STEM opportunities (Ng, 2025). Singaporean students are provided with a broad-based curriculum in the early years, and more targeted enrichment opportunities such as research-based science programs or robotics clubs are layered in progressively.

Singapore's success stems not only from high achievement but also from an intentional, equity-focused approach to curriculum and teacher preparation. Prospective teachers are recruited from the top third of graduates, receive training at the National Institute of Education, and benefit from mentorship by master teachers. Teacher selection, training, curriculum design, and ongoing professional development are coordinated by Singapore's Ministry of Education to ensure rigorous and equitable instruction across all schools. By investing in providing access to students and committing to teacher training and development, Singapore has created an education system that attempts to limit the replication of social inequities (Asia Society Global Cities Education Network, 2017)

Germany provides another practical case study as Germany scored above the OECD average in both mathematics and science, ranking 20th and 16th, respectively, in 2018 (OECD, 2019). While German students perform well overall, the country has long struggled with equity

challenges due to its early academic tracking system. Students were sorted into the secondary school pathways of academic, vocational, or general education by the end of Grade 4 or 6, depending on the state. This rigid structure was criticized for reinforcing social stratification and limiting mobility, particularly for immigrant and working-class students (OECD, 2012). In response, some German states have begun to delay tracking and increase flexibility between pathways, allowing greater permeability between vocational and academic routes. Germany utilizes a dual education system that integrates classroom learning with applied STEM experiences in industry to bridge academic rigor with career readiness.

Finland, by contrast, resists early academic stratification altogether as Finnish students remain in a common comprehensive school through Grade 9. This common school model ensures that all children, regardless of socioeconomic background, receive a strong educational foundation before selecting specialized upper secondary pathways (Sahlberg, 2015). Along with this common school model, Finland has policies that ensure resources are directed toward schools serving disadvantaged populations, special education services are integrated into regular classrooms, and all teachers hold master's degrees in education. Moreover, Finland places a high degree of trust in teachers, giving them substantial autonomy over curriculum delivery within a nationally coherent framework. These measures have helped Finland combine high performance with one of the narrowest achievement gaps among OECD countries, demonstrating that equity and excellence are mutually reinforcing rather than competing goals (OECD, 2019).

The models from Singapore, Germany, and Finland reinforce a shared truth: equity in STEM education is most effectively advanced when systems limit early stratification, provide strong academic foundations across all schools, and strategically align resources to meet diverse student needs. For New York City, this means drawing on Singapore's systemwide supports, Germany's industry–education integration, and Finland's comprehensive, de-tracked foundation. Building from this foundation, NYC must enact a three-part strategy to close the STEM opportunity gap through admissions reform, targeted STEM magnet expansion, and a needs-based funding formula. Together, these levers offer a systemic approach to ensuring that all students, regardless of background, have the preparation and access required to thrive in high-quality STEM pathways.

Overview of the Policy Strategy

New York City can build a coherent, inclusive, and talent-affirming STEM pipeline nased on international models that integrate equity and excellence. To dismantle entrenched barriers within the NYC education system, this paper proposes a three-part strategy that balances rigor with inclusion, aiming to cultivate equitable STEM opportunity at scale.

1. Revise high school admissions by reducing reliance on academic screens and introducing equity set-asides to expand access for historically marginalized students.

2. Develop inclusive STEM magnet programs in under-resourced districts, beginning in elementary school, to increase early exposure to advanced STEM pathways.

3. Implement a STEM-specific, needs-based funding formula that ensures schools possess the infrastructure, teacher expertise, and learning resources necessary to sustain high-quality STEM education.

Rationale of Policy Strategies

1. De-Tracking Education and High School Admissions Reform

In New York City, screened admissions and admissions tests continue to restrict access to STEM pathways. Even after geographic rezoning in 2021 intended to reduce segregation and expand opportunity, more than 100 schools still use academic screens that disproportionately exclude Black, Latino, and low-income students (NYC DOE, 2022). Admissions reform through fe-tracking is about removing selective admissions but also ensuring that all students have equitable access to critical 'gateway' STEM courses well before high school. One of the clearest examples is universal Algebra I by 8th grade. Decades of research show that students who complete Algebra I before high school are far more likely to take advanced mathematics and science courses, including AP Calculus, AP Physics, and engineering electives, and are more likely to enter and complete a STEM degree (Bozick & Ingels, 2008; Wang & Degol, 2013). Currently, access to Algebra I in middle school is highly unequal across NYC. Many middle schools in low-income districts do not offer the course at all, effectively locking students out of the highest-level STEM pathways before they even start high school. By contrast, wealthier districts often provide Algebra I by 8th grade as the norm, giving students a multi-year head start. Adopting a universal Algebra I by 8th grade policy, paired with tutoring, double-period math blocks, and summer bridge programs to ensure mastery, would directly align NYC with top-performing international systems.

In Finland, a common comprehensive curriculum through Grade 9 ensures all students, regardless of background, receive the same rigorous math sequence before choosing specialized pathways (Sahlberg, 2015). This education model delays high-stakes tracking until after students

have a shared, strong mathematical foundation and Finland has consistently seen stronger national performance and narrower achievement gaps than the United States.

Along with universal Algebra 1 in 8th grade, admissions reform would include admissions lotteries for specialized high schools. These lotteries would include equity-based set-asides for students from low-income ZIP codes or underperforming districts, and this reform would expand the pool of students academically prepared to excel in advanced STEM programs.

2. Creating accessible STEM Magnet Programs

Having a lottery system to increase the number of marginalized students in specialized high schools would not solve the issue of proper access to quality education if those students were not adequately prepared for rigorous coursework. If equity without access to quality preparation won't deliver meaningful results, the NYC Department of Education should establish several STEM magnet schools in under-resourced areas, modeled after Singapore's inclusive, tiered system of STEM enrichment. Singapore consistently ranks among the top globally in PISA assessments, with minimal performance disparity between low- and high-income students (OECD, 2019).

Magnet schools should incorporate hands-on STEM instruction from the earliest grades, such as design thinking, robotics, applied science labs, and coding. For example, in Germany's dual education system, vocational and academic STEM tracks are integrated with industry internships to enhance career readiness while maintaining rigorous academic standards (OECD, 2012). A similar model in NYC would mean schools leveraging partnerships with local universities and industry to provide real-world experiences and mentorship, including research projects with NYU Tandon or internships at Con Edison.

Finally, accessibility to these magnet schools must be ensured through free, reliable transportation, so that students from any borough can attend a magnet school without logistical or financial barriers. By combining inclusive admissions, universal Algebra I by 8th grade, and deep industry-university partnerships, NYC's STEM magnets could become both engines of academic excellence and drivers of equitable access to high-quality STEM careers.

3. Creating STEM-Specific Needs-Based Funding Formula

Reforming admissions and increasing accessible STEM programming will fall short unless resource inequities are addressed. High-quality STEM instruction requires well-equipped labs, certified teachers, transportation access, and a coherent early acceleration plan that gives all students the same gateway opportunities, such as Algebra I by 8th grade. A weighted STEM funding formula would allocate additional per-pupil funds to schools (both middle and high) based on indicators such as:

- Absence of Algebra I access by 8th grade in the feeder pattern.
- Lack of AP STEM courses or equivalent advanced offerings.
- Insufficient lab infrastructure or modern technology resources.
- STEM teacher shortages, especially in physics, chemistry, computer science, and higher-level math.
- High concentration of low-income students, measured by free or reduced-price lunch eligibility.

By tying resource allocation directly to specific STEM capacity gaps, NYC can ensure that all students enter high school prepared to thrive in rigorous STEM pathways. This approach also builds accountability into funding as schools receiving additional STEM equity dollars would be required to publicly report progress on Algebra I access, advanced STEM course enrollment, and performance disaggregated by race, ethnicity, and income.

Addressing Barriers to Effective Strategy Implementation

Barrier 1: Political Resistance to De-Screening

As Former Mayor de Blasio's 2018 proposal to replace the SHSAT with a middle school rank-based system was met with strong backlash from parent advocacy groups, alumni associations, and elected officials, I expect similar resistance to occur with this admissions reform. One method to assauge dissenters is to reference evidence-based research, for example. Roda & Wells found that integrated, high-achieving schools can maintain or raise performance for all students (Roda & Wells, 2013). Using evidence, policymakers can frame de-screening as a strategy to promote excellence and broaden the pool of students prepared for advanced coursework. Additionally, policymakers and advocates would have to build coalitions of civil rights advocates, grassroots organizers, and STEM industry partners to drum up support for these policies and assuage citizen concerns. In Panel for Education Policy meetings, concerns should be addressed, but met with tangible insight on how the increased diversity in NYC's gifted programs will benefit all students and still provide quality education

Barrier 2: Institutional Inertia and School-Level Autonomy

In adding additional requirements to schooling, there could be pushback from principals and school communities, who believe the new mandates were implemented without their support or school vision in mind. NYC's Renewal Schools program, for example, struggled partly because reforms were rolled out broadly without piloting or strong local buy-in, while initiatives like Computer Science for All succeeded by resourcing early adopters and recognizing their work publicly. Before rolling out the new reforms all at once, I suggest policymakers first use an opt-in pilot model for revised admissions and STEM magnets. In this model, financial incentives, dedicated teacher recruitment support, and tailored instructional resources can be offered and

then workshopped to increase the efficacy of implementation. Once results are created, the Department of Education should publicize and market these results to create organic demand from other schools rather than forceful implementation of reform. While this process would take a few more years to have the vision fully implemented, the slow rollout should decrease institutional pushback or misaligned implementation.

Barrier 3: STEM Teacher Shortages

If the goal of reform is to increase students' access to quality STEM education, then New York City must be able to supply an adequate number of qualified teachers to meet this new demand. At present, the STEM teacher turnover rates are nearly double those in affluent schools (Learning Policy Institute, 2022), and there are shortages of certified physics, chemistry, computer science, and advanced math teachers. This barrier, if not overcome, would create challenges to sustaining advanced programs in the communities that need them most. One strategy to overcome this barrier would be to establish a STEM Educator Pipeline in partnership with CUNY and SUNY schools that guarantees placement for certified teachers in shortage subjects. In conjunction with these partnerships, the city can offer targeted incentives, including loan forgiveness, salary differentials, and housing stipends for teachers who are in high-need subjects to teach in marginalized communities and their new magnet programs. Additionally, the Department of Education can partner with CUNY and SUNY schools to create summer STEM teaching institutes focused on equity-centered instruction to further develop teachers and the quality of their instruction.

Conclusion

New York City's STEM education system faces a pivotal choice, either preserve an inequitable two-tiered structure or commit to inclusive excellence. International models from Singapore, Finland, and Germany show that delaying tracking, investing in teacher quality, and ensuring universal access to rigorous coursework can simultaneously raise achievement and close gaps between socioeconomic classes. The policy solutions of reforming admissions, expanding inclusive STEM magnet programs, and adopting a STEM-specific, needs-based funding formula would ensure that talent, not family income or ZIP code, determines opportunity. To best implement these policy changes, policymakers need to address political resistance, institutional alignment, and teacher shortages, which will be essential for success. By acting now, we will strengthen the city's innovation pipeline, expand opportunities for historically marginalized students, and secure New York's position as a 21st-century leader in science, technology, and innovation.

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