Expanding Access to Quality STEM Education in Texas

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Executive Summary

Texas, renowned for its innovative spirit and economic dynamism, has consistently aimed to lead the nation in science, technology, engineering, and mathematics (STEM) fields. However, these aspirations are tarnished by persistent inequities in K-12 STEM education, particularly among economically disadvantaged students. This policy brief presents a multifaceted strategy to tackle these disparities and enhance STEM education opportunities for all students. The proposed approach emphasizes the automatic enrollment of all Texas public school districts and campuses into the Texas EcosySTEM initiative, targeted funding allocation for underserved districts, and the establishment of a dedicated equity-focused team to track, analyze, and mitigate disparities within the education system.

I. The Texas STEM Landscape

Texas, with the nation's second-largest GDP, is undoubtedly an economic powerhouse. Its economy thrives on the diversity of industries, and at the heart of many of them lies the ever-expanding realm of Science, Technology, Engineering, and Mathematics (STEM). Home to global giants like ExxonMobil, Dell Technologies, and Texas Instruments, the Lone Star State has firmly established itself as a leader in the world of STEM.

In fact, Texas is a fertile ground for innovation and scientific discovery. The state boasts more than 5,500 life science and research firms, employing over 98,000 professionals. From biotechnology to healthcare, pharmaceuticals to agriculture, and medical device manufacturing to cancer research, Texas stands at the forefront of scientific progress.

Texas excels in various STEM-related fields. It ranks first in the nation for chemical engineers, and second for clinical laboratory technologists and technicians, and biological technicians. The Cancer Prevention Research Institute of Texas (CPRIT), created in 2007, is the largest taxpayer-funded cancer research organization in the U.S., with more than $6 billion dedicated to research grants. Additionally, Texas is at the forefront of battling health crises like COVID-19, with institutions like the University of Texas' Austin Technology Incubator leading a consortium of over 50 healthcare organizations to tackle the pandemic.

One of Texas' crowning achievements is its emphasis on higher education and research. The state hosts seven of the nation's top 100 medical schools, channeling approximately $5.6 billion annually into research and development. Additionally, Texas is third in the country for biological/biomedical and life science doctorates awarded, second for health science doctorates, and first for agricultural science doctorates.

While Texas shines in the professional STEM arena, its K-12 STEM education system faces significant challenges. Despite its economic prowess and scientific accomplishments, Texas lags behind in national science and math education rankings. The state currently stands at 23rd in science education and 25th in math education.

To bridge this gap and prepare the next generation for STEM careers, the Texas Education Agency has initiated a multifaceted approach. This includes the development of a STEM Education Framework, which promotes hands-on, project-based learning to equip students with problem-solving skills and innovative thinking. Complementing this framework is the Texas EcosySTEM initiative, a collaborative effort that unites stakeholders from various sectors to enhance access to STEM-rich learning environments.

The EcosySTEM regional STEM hubs, established across the state, are designed to bring together educators, workforce development boards, chambers of commerce, businesses, and non-profits. These hubs play a pivotal role in aligning

learning pathways from Pre-K to higher education, ensuring that students are well-prepared to meet the evolving demands of the workforce.

However, as promising as these initiatives are, there are still stark disparities in district data. Inequities in STEM education persist, and it's evident that much work remains to be done to ensure equal access to high-quality STEM learning opportunities for every student in Texas. Recognizing these challenges is a crucial step toward building a more inclusive and robust STEM education system.

II. Understanding STEM Inequities

While Texas shines as an economic powerhouse with a thriving STEM workforce, there's a stark contrast when it comes to its K-12 STEM education system. The State of Texas Assessments of Academic Readiness (STAAR) end-of-course exams, designed to measure students' mastery of specific course material, reveal alarming disparities in educational outcomes across school districts.

Understanding STAAR End-of-Course Exams

The STAAR end-of-course exams are a critical component of Texas' education system. These assessments, rooted in the Texas Essential Knowledge and Skills (TEKS), the state's curriculum standards, are aimed at ensuring that high school students are adequately prepared for college and careers. Required for students who entered the ninth grade in the 2011-2012 school year or later, these exams include English I, English II, Algebra I, Biology, and US History.

These exams employ a scale score system, allowing for a nuanced evaluation of students' performance. The scale score enables the determination of whether a student has achieved one of the four performance standards (Masters, Meets, Approaches, or Did Not Meet Grade Level), where all are considered a passing score except Did Not Meet Grade Level.

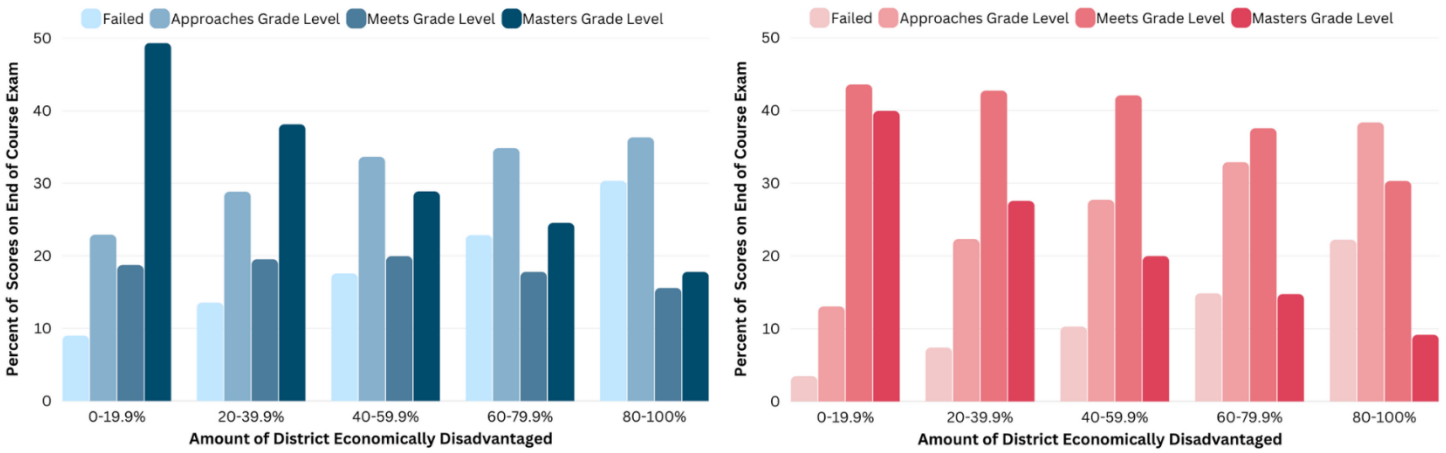
Analyzing STAAR Data and Inequities

To better understand the educational landscape, we turned to district-wide STAAR results and demographics for the 2020-2021 academic year, as reported by the Texas Education Agency. Our analysis focused on Traditional Independent School Districts (excluding Charter School Districts) with available data, resulting in a dataset of 970 school districts.

The key findings shed light on glaring inequities tied to economic disadvantage within districts. We examined the rates of students achieving various end-of-course exam scales, particularly in Algebra I and Biology, in relation to the percentage of economically disadvantaged students. Economic disadvantage was determined by students qualifying for the free or reduced lunch program.

The data reveals a distressing trend: as the percentage of economically disadvantaged students in a district rises, so do the rates of students failing Algebra I and Biology exams.

When districts have a low percentage of economically disadvantaged students (0-19.9%), the failure rates are notably lower. A mere 9% of students failed their Algebra I exams, and only 3.5% failed Biology. However, when economically disadvantaged students make up 80-100% of a district, the failure rates increase dramatically to 30% for Algebra I and 22% for Biology exams.



The rates of students earning each of the performance standards on their End of Course Algebra I (left) and Biology (right) exams, with respect to the amount of their school district that is economically disadvantaged. Source: Texas Education Agency

The Urgent Need for Equity in Education

These findings underscore the pressing need for equity in Texas' STEM education system. The correlation between economic disadvantage and academic achievement is a stark reminder of the unequal opportunities that students face based on their socio-economic status.

While Texas excels in its STEM workforce and higher education, the state must address the systemic inequities that hinder the academic success of many K-12 students, particularly those from economically disadvantaged backgrounds. It is essential to recognize that the path to a prosperous STEM career begins in the early stages of education. Therefore, ensuring that all students, regardless of their economic circumstances, have access to high-quality STEM education is paramount.

III. Proposing Policies to Strengthen STEM Education and Bridge Equity Gaps in Texas

In our quest to enhance STEM education across Texas and address the glaring equity gaps that persist within our educational system, we present a series of meticulously crafted policies. These initiatives, when implemented with precision, hold the potential to transform STEM education, ensuring that every Texan student has access to quality opportunities, regardless of their socio-economic background.

Recommendation 1: Funding and Expansion of Texas EcosySTEM

Our first policy directive involves securing support from the Texas state legislature and allocating dedicated funding to significantly expand the Texas EcosySTEM initiative. While the Texas Education Agency provides a platform for STEM Grant Opportunities, currently, there is no funding available at the state level to facilitate the expansion of this program. Our proposal seeks to rectify this gap.

The enhanced funding will empower the Texas EcosySTEM initiative to roll out targeted programs and strategies aimed at improving STEM education comprehensively throughout the state. This funding will facilitate the development of STEM resources, teacher training programs, and support mechanisms for schools in need.

By strengthening the Texas EcosySTEM program, we aim to provide an equal playing field for all students, irrespective of their geographic location or the economic status of their school district.

Recommendation 2: Inclusivity Through Automatic Enrollment

Our second policy recommendation revolves around fostering inclusivity in STEM education by transitioning from an opt-in to an opt-out model. We propose that all Texas school districts and public school campuses are automatically enrolled in the Texas EcosySTEM program, with the option for districts to opt-out if they find it unsuitable for their unique circumstances.

Research in behavioral economics shows that shifting from opt-in to opt-out defaults significantly increases participation rates in voluntary programs. By automatically enrolling all districts in their regional Texas EcosySTEM, we ensure broader access to STEM resources, democratizing the benefits of this initiative across the state.

This policy shift not only eliminates barriers to entry but also ensures that all schools have the opportunity to leverage the resources and expertise provided by the Texas EcosySTEM program, ultimately leading to an improved STEM education landscape.

Recommendation 3: Establish an Equity Taskforce

To address the pressing issue of equity in STEM education across Texas, we propose the establishment of a dedicated Equity Taskforce within the Texas EcosySTEM framework. This taskforce will play a pivotal role in continuously tracking district and campus data, with a specific focus on demographics, enrollment in special programs, test scores, college admissions, and attendance.

The concept for this taskforce draws inspiration from the National Academies, particularly the Board on Science Education (BOSE) in partnership with the National Academy of Engineering (NAE). Their collaborative efforts support a project aimed at providing practical, evidence-based guidance on promoting educational equity in STEM education, encompassing all levels of the PreK-12 system. The National Academies' project involves the creation of an ad-hoc committee who will: identify and describe inequity in PreK-12 STEM education, review evidence on policy and program interventions, and develop recommendations for policy, practice, and research to promote success for all students.

By adopting a similar approach within the Texas EcosySTEM framework, we can model our Equity Taskforce's operations after the best practices and rigorous research employed by the National Academies. This approach ensures that our efforts to bridge equity gaps in STEM education are informed by evidence, well-structured, and tailored to the unique challenges faced by Texas school districts and campuses.

The Equity Taskforce will have the vital responsibility of not only identifying the equity gaps but also crafting actionable recommendations that draw from the National Academies' research and other reputable sources. These recommendations will then inform targeted strategies and initiatives aimed at closing these gaps and promoting equitable access to high-quality STEM education throughout Texas.

Recommendation 4: Local Partnerships for Enriched STEM Education

Our final policy proposal, inspired by initiatives such as the Educate Texas program, centers on enriching STEM education through local partnerships. We advocate for the development of programs designed to initiate change in underserved districts and campuses, akin to the successful efforts seen in certain regions of Texas.

The Educate Texas program, for instance, has already demonstrated the transformative potential of local partnerships in southern Dallas County. By partnering with local school districts like Cedar Hill ISD, Desoto ISD, and Lancaster ISD, Educate Texas has expanded STEM educational programs and opportunities, reshaping the teaching and learning of STEM subjects across all grade levels.

We recommend allocating dedicated funding for statewide implementation of similar programs, empowering all Texas school districts to forge partnerships with local corporations and universities. Appointing individuals responsible for nurturing these collaborations can ensure that students in every corner of the state have access to enriching STEM experiences.

This policy builds upon the goals of the Texas EcosySTEM program, aiming to expand its reach statewide while drawing inspiration from the success stories of programs like Educate Texas. By fostering local partnerships, we can tap into additional resources, mentorship programs, and real-world experiences that will elevate students' STEM education and prepare them for the challenges and opportunities of the future. These partnerships can create a sense of community and shared responsibility for the success of our future STEM leaders, ensuring a brighter, more equitable future for all of Texas.

These four policies represent a comprehensive approach to improving STEM education in Texas. By expanding the Texas EcosySTEM initiative, promoting inclusivity through automatic enrollment, establishing an Equity Taskforce, and encouraging local partnerships, we can bridge the equity gaps that currently plague our educational system. These policies, when enacted, will empower all Texas students to excel in STEM fields, driving innovation and prosperity throughout our great state.

IV. Conclusion: The Path Forward

In conclusion, equitable access to quality STEM education is critical for Texas to maintain its competitive edge and prepare its students for the future workforce. The current disparities in STEM education cannot be ignored, especially for economically disadvantaged students who face significant barriers.

By securing congressional support and allocating dedicated funding to expand and enhance the Texas EcosySTEM initiative, Texas can take a significant step towards addressing these disparities. Automatic enrollment, the establishment of an equity team, and forging local partnerships will ensure that all districts and campuses have the resources and support needed to provide quality STEM education.

Additionally, leveraging the upcoming report from the National Academies of Sciences, Engineering, and Medicine will provide valuable insights and evidence-based recommendations for further improving STEM education in Texas. It is imperative that Texas legislators prioritize this issue and take action to bridge the gap, ultimately building a STEM education system that works for all students, regardless of their background.

References

Davidai, Shai, Gilovich, Thomas, and Lee D. Ross. 2012. “The meaning of default options for potential organ donors”. *Proceedings of the National Academy of Sciences*. 109 (38): 15201-5. https://doi.org/10.1073%2Fpnas.1211695109

Educate Texas. 2021. “Communities Foundation of Texas Annual Report”. https://www.cftexas.org/most

National Academies. 2023. “Equity in PreK-12 STEM Education”. https://www.nationalacademies.org/our-work/equity-in-prek-12-stem-education

The Texas Economic Development and Tourism Office (EDT). 2021. “Texas Biotechnology Industry”. https://gov.texas.gov/uploads/files/business/Bio_LifeScienes_May2021.pdf

The Texas Education Agency. 2023. “Texas EcosySTEM” https://tea.texas.gov/academics/college-career-and-military-prep/texas-ecosystem

U.S. Department of Education. Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2015 Science Assessment.

U.S. Department of Education. Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2022 Mathematics Assessment.

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