



Published in final edited form as:

Acad Med. 2014 January ; 89(1): 37–42. doi:10.1097/ACM.0000000000000047.

The Health Sciences and Technology Academy: An Educational Pipeline to Address Health Care Disparities in West Virginia

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Abstract

Health and educational disparities are national issues in the United States. Research has shown that health care professionals from underserved backgrounds are more likely than others to work in underserved areas. The Association of American Medical Colleges' Project 3000 by 2000, to increase the number of underrepresented minorities in medical schools, spurred the West Virginia School of Medicine to start the Health Sciences and Technology Academy (HSTA) in 1994 with the goal of supporting interested underrepresented high school students in pursuing college and health professions careers. The program was based on three beliefs: (1) if underrepresented high school students have potential and the desire to pursue a health professions career and are given the support, they can reach their goals, including obtaining a health professions degree; (2) underserved high school students are able to predict their own success if given the right resources; and (3) community engagement would be key to the program's success.

In this perspective, the authors describe the HSTA and its framework and philosophy, including the underlying theories and pedagogy from research in the fields of education and the behavioral/social sciences. They then offer evidence of the program's success, specifically for African American students, including graduates' high college-going rate and overwhelming intention to choose a health professions major. Finally, the authors describe the benefits of the HSTA's community partnerships, including providing mentors to students, adding legislative language providing tuition waivers and a budgetary line item devoted to the program, and securing program funding from outside sources.

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Other disclosures: None.

Ethical approval: None.

Disclaimer: The views expressed in this article are those of the authors and do not necessarily represent the views of the funding agencies or of other federal agencies.

Health disparities and educational disparities are national issues.^{1–5} They are particularly troublesome in rural West Virginia, a state that ranks among the worst in obesity-related illnesses^{6–8} and in educational attainment.^{9,10} To add to the complexity of addressing these issues, health care professionals from underserved backgrounds are more likely than others to provide health care to underserved populations.^{11–14} However, the process of nurturing educationally disadvantaged students to be successful in college and in health professions school is costly,^{15,16} time consuming, and energy intensive.¹⁷ Programs targeting students in grades K-12 must wait 20–30 years for results. Furthermore, programs targeting students for the first time at the college level often miss students from underserved populations due to the barriers these students face before reaching college.^{18,19}

In the early 1990s, the Association of American Medical Colleges' Project 3000 by 2000 spurred the West Virginia University School of Medicine to action. University leaders started the West Virginia Health Sciences & Technology Academy (HSTA), a pre-college program, in 1994 to address the serious problems of an undereducated workforce and a large medically underserved population in West Virginia. We began the program with three beliefs. First, if underrepresented high school students have potential and the desire to pursue a health professions career and are given the support, they can reach their goals, including obtaining a health professions degree. Second, underserved high school students are able to predict their own success if given the right resources. Finally, community engagement would be key to the program's success. The partnership between the community and the HSTA has allowed for the program's sustainability and has nurtured the students' success, in turn strengthening the communities in which graduates live and work.

In this perspective, we offer findings from the first 14 years of the program. We focus on key aspects of the HSTA's success in recruiting and preparing health professionals from underserved populations.

About the HSTA

Of all HSTA students, 32% are African American, 63% financially disadvantaged, and 73% the first in their families to attend college. We select students from a pool of capable applicants recruited by community leaders. Those who express the strongest interest, greatest potential, and the most need for support are chosen. In 1994, the HSTA began with 44 students from two West Virginia counties. Now, the program serves approximately 800 underrepresented high school students (grades 9–12) each year from nearly half the counties in the state. Students enter the HSTA in the ninth grade and matriculate if they maintain a 3.0 or better GPA, attend 70% of the HSTA functions, attend two summer campus experiences (camps), complete 75 hours of community service, and adhere to all disciplinary policies. Successful graduates are eligible for tuition waivers to all state-supported colleges or universities, health professions schools, and many graduate schools.

Each summer, students have the opportunity to participate in one of four sequential camps at different college/university campuses. These camps include laboratory and classroom training as well as enrichment activities designed to equip students with skills and experiences suitable for a seamless entry into college. The camp curriculum, for each successive grade, builds on that of the previous grades to expose students to increasingly more rigorous educational experiences associated with careers in the health sciences.

Throughout the academic year, HSTA-trained teachers lead students in local, community-based after school clubs. The students engage in scientific research to produce projects that focus on health related issues relevant to their interests and endemic to their local communities. As part of these clubs, scientists, peer mentors, and community leaders provide guidance for students. Leadership, communication, and resource skills along with

teamwork are woven into the experience, with the expectation that each student presents his or her project's findings formally in a public setting and engages in at least 75 hours of community service over the four years.

HSTA Framework and Philosophy

The HSTA employs a framework of yearly, multilayered, and multifaceted strategies and support systems to increase access to college for underrepresented students. The program's philosophy for achieving this goal includes theories and pedagogy from research in the fields of education and the behavioral/social sciences. Below, we describe these strategies and the underlying theories and provide examples from the program and representative quotes from students.

High expectations for all students

Research has shown that having high expectations of students translates to high rates of academic success as well as elevated levels of self-concept.²⁰⁻²² The HSTA creates an environment in which all students are expected to achieve at high levels through academically rigorous scientific activities and the promotion of higher order thinking skills. HSTA staff and faculty surround students with these expectations, measured by rubrics, requirements, and grades in college level courses (taken during their final summer camp). These expectations are embedded in the encouragement students receive to help them achieve their goals.

Academic support

Experts argue that students who take challenging courses and participate in academically rigorous work are more likely than those who do not to enroll in and complete Bachelor's Degree programs.²³ HSTA clubs, with a 10:1 student to teacher ratio, allow teachers to provide individualized academic support for each student. According to one participant, "[b]eing in HSTA my grades in science went from a C to an A so HSTA is one of the best things that has happened to me."

Learning by doing

Education expert John Dewey posited that students do best in environments where they are allowed to interact and experience the curriculum so that they have the opportunity to take part in their own learning.²⁴ Faculty at the HSTA embrace this theory through hands-on, experiential activities in which students construct meaning from their experiences. During a campus-based experience, one student reflected the following:

I liked how we got to dissect the sheep hearts, kidneys, eyes, and how we could dissect the cow eyes. We learned how to cut in the right places and how to focus on the chambers of the heart and the lens of the eye because those were the two features that were closer to humans.

Through repeated project work and summer camps, the HSTA builds students' skills year after year. A constructivism/discovery learning approach is used to encourage students to construct new ideas or concepts based on their existing knowledge. Students also apply their skills and past learning experiences to discover the relationship between facts and experiences in their research projects.²⁵

Building success

We believe that students with a strong sense of efficacy are more likely to pursue increasingly difficult tasks and become more motivated. Over the four years, the HSTA immerses students in increasingly rigorous activities that reaffirm their action steps towards

developing skill sets for success. Through this process, students realize their capacity to succeed and have stronger beliefs that they can achieve success.

Social support

Social scientist Albert Bandura argued that providing social support is a key to promoting student achievement and fostering self-worth, which make academic success seem attainable.²⁶ Constructs of observational learning and peer modeling as well as Social Development Theory indicate not only that social interaction is crucial to cognitive development but also that students learn through modeling and peer observations.²⁷ The HSTA surrounds students with opportunities for both social interaction and peer modeling. One student noted that “[t]he people in my HSTA group are longtime friends and when I may not understand something, they are there to help me with any problem that may occur.”

Students also receive social support during the campus-based camps—they have mentors from similar backgrounds who have successfully completed the HSTA program and now attend college or a health professions school. One participant noted that “[m]y mentor is going to school to be an occupational therapist, and I was interested in physical therapy, and she gave me more of an idea about what the classes were like.”

The HSTA also includes an informal mentoring program in which alumni periodically visit clubs and mentor the students on their yearly research projects as well as on the process of preparing for college. The alumni use stories of their personal success to motivate the current students to reach their goals.

Finally, we have found that parent/family involvement in a student’s education results in better scholastic achievement.²⁸ The HSTA recognizes the importance of including students’ cultural references in all aspects of learning. Thus, the program provides support for parents, teachers, community leaders, extended family, and friends. The HSTA coordinates parent meetings and encourages parental involvement in the science symposia, a community based component of the program during which students present their project’s findings publicly. By understanding the social and cultural environment of our students, the HSTA is better able to meet their needs and encourage their success.

Success of the HSTA

The HSTA has had a great deal of success tracking students after their high school graduation. Staff collect data through yearly telephone, social media, and email interviews with students, and the web information maintenance form that students complete yearly provides additional data. Of the 1,402 students who successfully completed the HSTA from 1997–2010, we were able to track the educational status of 1,311 (94%) students to college and beyond. Each year, we also survey each summer camp participant for his or her intentions to pursue college and intended degree choice.

Despite the robust data on HSTA students we have collected, we cannot draw comparisons between this and other populations. First, relative to the West Virginia population, African American, first generation to college, and financially disadvantaged students are overrepresented in the HSTA population. In addition, the same relationship exists for these groups relative to the national population. Finally, for a number of reasons—including issues with gaining consent from an already distrustful population and the difficulty with tracking for decades a large cohort with no incentive to participate—we did not identify a control population against whom to compare our students.

With these limitations in mind, however, we can report on HSTA students' success. We compared each summer camp participant's intentions to pursue a college degree to the outcomes achieved by HSTA graduates. Not all HSTA students attended summer camps each year, but all graduates attended at least two camps over their four years in the program. As ninth to twelfth graders, HSTA students were fairly accurate, slightly underestimating their college-going rates. Of summer camp participants, 93% (3,537/3,813) indicated that they would definitely attend college, while 96% (1,263/1,311) of HSTA graduates actually attended college. These trends held for African American students, for whom the college-going rate was high. Of African American summer camp participants, 95% (884/932) indicated that they would definitely attend college, while 97% (375/386) of African American graduates actually attended college.

We also compared each summer camp participant's intentions to choose a health professions major (medicine, pre-med, physician assistant, nurse, nurse practitioner, dentistry, pharmacy, etc.) (see Table 1) to the outcomes achieved by HSTA graduates. Again, HSTA students, as ninth to twelfth graders, were fairly accurate in predicting their high rates of choosing a health professions major. Of summer camp participants, 66% (2,500/3,767) indicated that they would pursue a health professions major, while 59% (725/1,226) of HSTA graduates actually did. Of African American summer camp participants, 60% (548/921) predicted that they would pursue a health professions major, while 52% (189/367) actually did.

Overall, HSTA graduates have been successful in pursuing post-secondary education--they attend college, stay in college to graduate, and major in science, technology, engineering, and math (STEM) subjects at higher rates than both the general West Virginia and the national population (see Figure 1). For example, 96% of HSTA graduates attend college, 90% graduate with a four year degree or better, and 65% major in a health or STEM subject, with 59% specifically choosing a health professions major. Furthermore, of the 2008–2010 economically disadvantaged HSTA graduates, 96% (191/200) immediately transitioned to college, compared to 20% of low income West Virginian students and 25% of low income American students in 2008.²⁹ The African American HSTA graduates outperformed their West Virginian and American counterparts as well. The 97% of HSTA African American graduates to attend college was greater than the 6% of West Virginian and 12% of American high school graduates to do so in 2009.³⁰ In addition, 84% of HSTA African American graduates have received a four-year degree, compared to 29% of West Virginian and 41% of American graduates in 2007.³¹ Finally, 90% of HSTA graduates live and work in West Virginia.

Community Engagement

An important tool for combating issues like the health and academic challenges faced by adults and children who live in rural and poverty stricken areas is community involvement.²⁸ Community-academic partnerships can serve a pivotal role in reshaping a community's economic, health, and education systems.^{32–36}

The primary goals of the HSTA are to increase the college-going rate among underrepresented students in West Virginia, to improve students' science and math skills acquisition, to empower communities through the leadership development of their youth, and to increase the number of health care providers in West Virginia's currently underserved communities. In 1996, West Virginia University reached out to community leaders to develop the HSTA with the expectation that local youth, after receiving academic or professional degrees, would return to their communities to fuel the economy and improve the quality of life for local citizens. The purpose of this collaboration was to encourage

higher education faculty members and administrators, public school teachers, and community leaders to assume, as a team, the responsibility for mentoring high school students.

Joint Governing Board

Citizens from local communities make up the governing body known as the HSTA Joint Governing Board. It includes two representatives and one alternate from each of the 14 regional local governing boards (encompassing 26 West Virginia counties), and one ex officio member from each of the following: West Virginia Higher Education Policy Commission, West Virginia Board of Education, the health professions schools in the state, and the colleges and universities that host the summer camps. The Joint Governing Board is responsible for all HSTA policies and procedures and decisions related to financial and budgetary, personnel, curriculum, recruitment and retention, and public relations issues.

Local governing boards

The 14 HSTA regions are governed by local governing boards responsible for communicating all appropriate matters to the Joint Governing Board for action and decision making; communicating these decisions to the appropriate HSTA regional entity; and ensuring that all HSTA policies and procedures are followed. The local governing boards include volunteers representing the community, local schools, local health care professions, and HSTA parents and students. The HSTA governance structure mandates that 51% of governing board members must be community volunteers. We believe that the success of the HSTA rests in the communities' feelings of ownership and control and in the trust that is built through these long-term partnerships between higher education entities, including public education institutions at the state and local levels, with a particular emphasis on rural communities.

Continuing community support

Evidence of the success of the community engagement portion of the HSTA includes legislative language providing tuition waivers and a budgetary line item devoted to the program.^{37,38} In 1997, the HSTA local governing boards partnered with West Virginia University leadership to gain unanimous backing for legislative language allowing a tuition waiver for HSTA graduates at any West Virginia public college/university in any undergraduate through health professions school program. In addition, that same year, the legislature inserted a line item in the budget with only HSTA's name on it. In a state where colleges and universities are numerous and competition for the limited state budget is fierce, community support for the HSTA was critical as both policy changes applied to all public colleges/universities, not just West Virginia University, home of the HSTA.

Sustainability is always an issue for programs like the HSTA. We attribute 20 years of successful funding to: (1) multiple and varied funding sources and (2) the support of community leadership. The HSTA began with a grant from the Howard Hughes Medical Institute, which provided funding for 19 years under the precollege initiative (see Figure 2).³⁹ Other funding sources included foundations such as Coca Cola, Kellogg, Robert Wood Johnson, and Claude W. Benedum. Many of these original funding sources have ended. However, new funding sources have taken over, supporting the budget of approximately \$2M/year. Current funding sources include the state of West Virginia, the National Institutes of Health, who has been supporting the program since 1996, and the Claude W. Benedum Foundation. In 2013, community partnerships contributed to securing all of the funding sources. In addition, we believe that these partnerships were the only reason that, during a state budget crunch, the HSTA line item in the state budget increased, while overall funding for higher education (where the line item is housed) decreased.

In Conclusion

Recognizing the limitations of the data, we do encourage replication of this program in the hopes of repeating its successful outcomes. To evaluate the success of such a program takes many years. Until the numbers of underrepresented students pursuing college and health professions degrees in West Virginia and nationally begin to rise, a solution has not been realized. Still, we can safely conclude that HSTA students attend college more often than their parents, and they do well there. They choose STEM majors more often than their peers and mostly return to work in their communities.⁴⁰ The HSTA's commitment to providing underrepresented students in West Virginia with these educational opportunities has resulted in a pool of qualified individuals ready to serve the health care needs of the state's rural and underserved populations. For example, rural Webster Memorial Hospital was struggling to find qualified employees in 1994. Today, eight HSTA graduates serve the hospital and the community in positions ranging from MD to emergency medical technician.⁴¹

With the support of the community, and the resources and opportunities to succeed, students from at risk populations are able to predict their intended educational outcomes. Furthermore, if they have potential and the desire to pursue a health professions career and are given the support to do so, they can reach their goals.

Acknowledgments

Funding/Support: Funding and support for the HSTA were provided by: the National Institutes of Health-Science Education Partnership Award (SEPA), West Virginia Legislature, Howard Hughes Medical Institute, and Claude W. Benedum Foundation.

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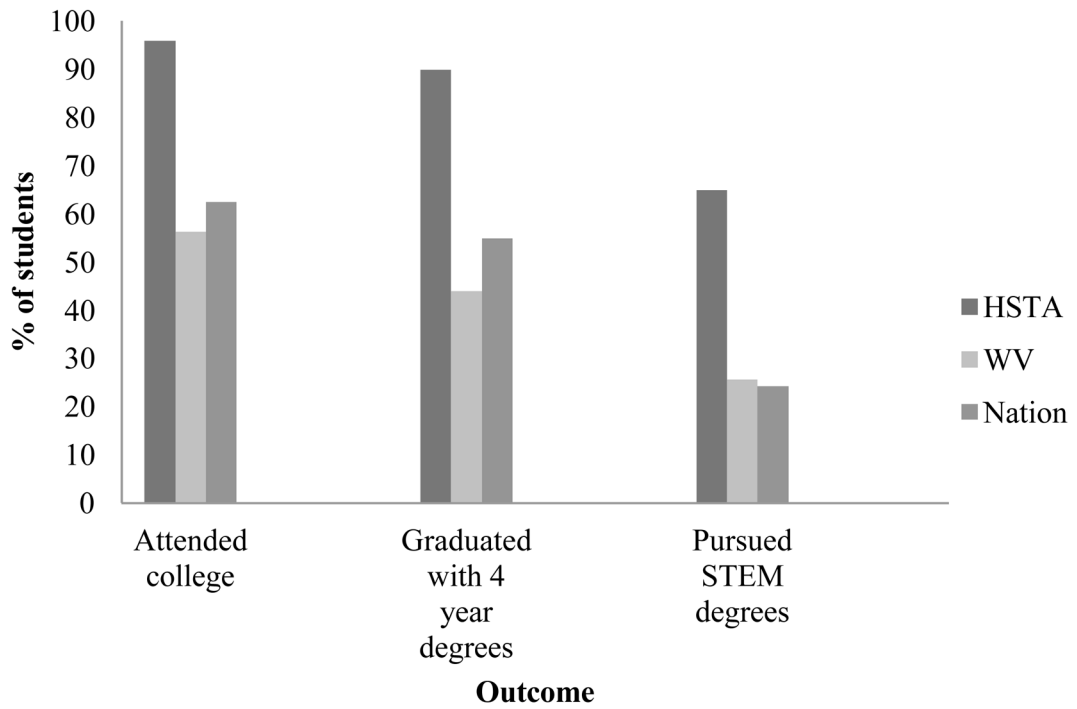


Figure 1. Comparison of college enrollment, graduation, and science, technology, engineering, and mathematics (STEM) majors between high school graduates from the Health Sciences and Technology Academy (HSTA), state of West Virginia (WV), and the United States (Nation). HSTA data are from 1997–2011, West Virginia data are from 2008 and 2011–2012, and national data are from 2008 and 2010–2011.^{42–45}

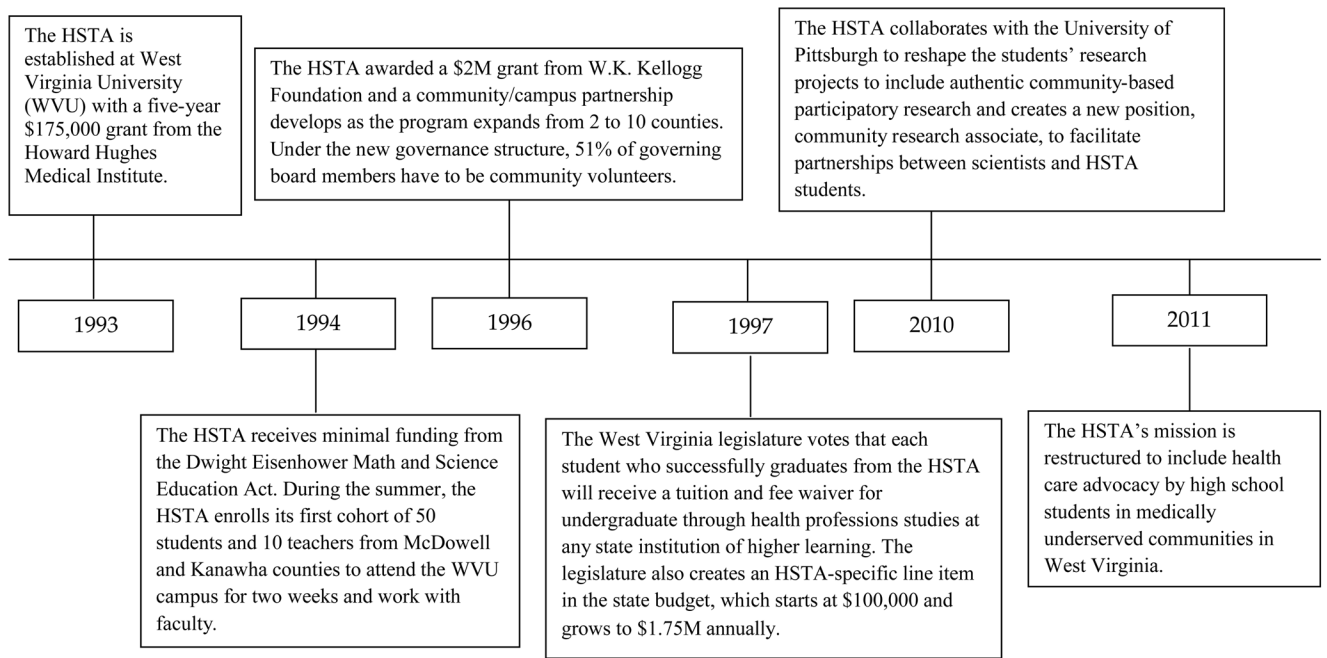


Figure 2. Timeline of major events in the history of the West Virginia Health Sciences and Technology Academy (HSTA).

Table 1

Health Care Professions Majors and Careers Chosen by Graduates of the West Virginia Health Sciences and Technology Academy, 1997–2011

Major/Career*	All graduates	African American graduates
Medicine and pre-med (MD, DO)	38	8
Medicine, non-MD (physician assistant, nurse practitioner, etc.)	10	1
Dentistry	7	2
Nursing	192	33
Pharmacy	25	4
Rehabilitative care (physical therapy, occupational therapy, sports medicine, etc.)	65	16
Patient care, other (medical assistant, respiratory therapy, etc.)	51	9
Public and community health	5	2
Health care administration	8	2
Mental health care	65	31
Radiology and related	26	5
Allied health care (speech pathology, audiology, etc.)	27	4
Research and pre-health care professional (biomedical science, biology, chemistry, etc.)	61	39

* Health professions degrees include associates degrees and professional degrees.