Hayes, C. (2024). Creating inclusive environments through authentic engineering design initiatives: Commentary on discussion at the 2024 National Technology Leadership Summit. *Contemporary Issues in Technology and Teacher Education, 24*(4), 579-581.

Creating Inclusive Environments Through Authentic Engineering Design Initiatives: Commentary on Discussion at the 2024 National Technology Leadership Summit

Chandra Hayes
Albemarle County Public Schools

Editor's Note: From time to time, the CITE Journal *publishes commentaries that provide added context for previously published articles. This commentary provides added context for work reported in the linked article. The editors would welcome additional commentaries that build upon and advance this dialog.*

The recent work by LaNika Barnes reported at the 2024 National Technology Leadership Summit (NTLS) can be situated in the context of the larger goals and mission of the Albemarle County Public Schools (ACPS). During summer 2024, students from the National Society for Black Engineers (NSBE) Jr., ACPS chapter, designed and fabricated 3D-printed microscopes during the course of a 6-week Summer Engineering Academy. The microscopes fabricated by the NSBE Jr. students are now being used in biology classes taught Ms. Barnes. The students' designs are also being replicated by their counterparts in FabLab Winam in Kisumu, Kenya.

The notable aspect of this work is that the students were not participating in a gifted program or advanced STEM track. In fact, they were academically average. The students were able to successfully design and fabricate a microscope with the support and scaffolding provided. The engineering students subsequently had the opportunity to observe biology students using the microscopes they fabricated. For some of the students, this may have been their first opportunity to participate in an academic leadership role. This experience can play an important role in formation of a STEM identity.

This work is part of ongoing ACPS efforts to achieve educational equity for all students in a diverse population. The goal is to enable every students regardless of background, abilities, or prior education experience, to realize their full potential. In many cases, this will entail individualized programs and mentorship of this kind, with a particular focus on historically underserved groups, including Black students, students with disabilities, and English language learners.

A recent instructional audit by Bellwether Education Partners revealed inconsistencies in curriculum implementation and instructional rigor, particularly in literacy and math. Recommendations from Bellwether emphasize the need for aligned and culturally relevant curriculum, along with systematic, ongoing professional development for teachers. These recommendations aim to enhance teachers' ability to support rigorous, grade-level instruction, especially for marginalized student groups who have traditionally faced academic disparities.

ACPS has begun implementing targeted changes to address achievement gaps and improve instructional practices. In order to align activities with ACPS's mission to foster a supportive and equitable learning environment for every student, and to close achievement gaps and create more opportunities for students of color, English language learners, and students with disabilities, ACPS has dedicated time and resources to ensure the engagement of all students, but specifically these subgroups.

Over the course of the next few years, ACPS will work to strengthen our partnerships with local colleges and universities as well as numerous civic and corporate organizations to ensure all students have access to high-quality learning experiences. Additionally, the division has prioritized training to help educators better engage students with grade-level content, while also creating more inclusive, affirming learning environments for all students.

The work of the NSBE Jr. students, led by Ms. Pearl Early, director of the ACPS NSBE Jr. program, is taking place within the larger context of the overall mission and goals of the school division described above. It is notable that all of the NSBE Jr. students who participated in the summer 2025 microscope design workshop have continued to remain engaged in this work throughout the fall semester. This can be attributed in part to the presence of an external audience — in this case, the use of the microscopes by biology students.

In a related initiative, the school division is exploring a collaborative partnership with a parallel group working at a Fabrication Laboratory (FabLab) in Kisumu, Kenya. FabLab Winam is in the process of replicating

the microscope design developed in Virginia. Kenya is on the equator, so its biome is very different from the biome in Virginia. A *Backyard Microscopy* project under development will enable students at each site to compare plant and insect specimens that they find in their local neighborhoods.

In both of the examples listed, that is,

1. use of the microscopes fabricated by the NSBE Jr. students in biology classes, and

2. use of microscope designs (and associated CAD files, etc.) developed by NSBE Jr. students by students and FabLab staff in Kenya

the presence of an external audience can play an important role in student engagement, mastery of skills and concepts, and continued participation.

This, in turn, can contribute to the division's goal of creating an "inclusive, affirming learning environment for all students."

Author Note

Chandra Hayes is the assistant superintendent of instruction in the Albemarle County Public Schools in Virginia