NATIONAL ALLIANCE FOR PARTNERSHIPS IN EQUITY
CASE STUDY

BRANDYWINE SCHOOL DISTRICT

INCREASE GIRLS' SELF-EFFICACY IN DESIGN AND ENGINEERING USING NAPE'S PIPE PROGRAM

By Mimi Lufkin and Nancy Tuvesson

CHALLENGE

Brandywine School District (BSD), like most districts, struggles with gender stereotypes that can limit a student's career options. These biases discourage students from considering the full range of occupations. Many of the fastest growing and most rewarding occupations are in nontraditional fields[1]—fields in which people from one gender comprise less than 25 percent of the workforce, for example men in nursing and women in engineering.

I think the most important skill for engineering is the ability to empathize. You have to be able to understand people's problems in order to improve them and understand the root causes of the problem in order to build things that help. ~ Meredith Haines, Student

Girls represented only 16.5% of students in the Design and Engineering (D&E) pathway in 2017. To address this underrepresentation, Brandywine High School (BHS) joined a cohort of schools to participate in the National Alliance for Partnerships in Equity (NAPE) Program Improvement Process for Equity™ (PIPE) in 2017-18. This professional learning project was supported by the Delaware Department of Education (DoE), and in 2018-19, it was expanded to include all three BSD high schools and three middle schools.

PIPE is designed to support educational institutions in identifying and removing barriers that prevent underrepresented students from pursuing nontraditional career and technical education (CTE) programs. ~ Dr. Ben Williams, NAPE CEO

[1] The Carl D. Perkins Career and Technical Education Act of 2006 required every state education agency to set negotiated performance indicators for career and technical education (CTE) and to annually report their progress toward achieving those indicators to the U.S. Department of Education. Two indicators focused on the participation and completion of students underrepresented by gender in nontraditional CTE programs. The reauthorization of Perkins in 2018, The Strengthening Career and Technical Education for the 21st Century Act (Perkins V), uses concentration of students underrepresented by gender.

SOLUTION

PIPE is an institutional change model designed to address educational systems' equity gaps. Over 12 months, a NAPE-certified equity instructor led cross-functional teams from BSD's high schools and middle schools through the five PIPE steps: **Organize, Explore, Discover, Select, and Act**.

A NAPE-certified equity instructor delivers and facilitates PIPE through training sessions and technical assistance calls over an academic year. PIPE culminates in a showcase event where teams present their PIPE implementation results and future plans.

Organize

Each BSD high school and their feeder middle school, **organized** a team of administrators, teachers, and counselors representing the CTE community to participate in PIPE training. The teams attended an orientation session and collected baseline data. See each schools baseline data in Table 1.

Explore

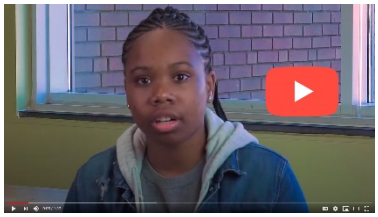
To identify performance gaps, the teams **explored** data at the state, school, and program levels. The teams disaggregated data by race, disability, and economically disadvantaged status and cross-tabulated by gender. Using NAPE-generated data dashboards, they selected D&E, which is part of the Engineering Technology Career Pathway, as the focus of their PIPE project.

Discover

The teams used NAPE's Nontraditional Career Preparation: Root Causes and Strategies to **discover** and evaluate the most direct root causes their students faced. They reached these conclusions using a combination of surveys, interviews, focus groups, and environmental scans to test their hypothesis.

Select

Using their action research results, the teams aligned root causes with evidence-based solutions to gendered performance gaps. A cost and resources matrix and SWOT (strengths, weaknesses, opportunities, and threats) analysis helped them determine the most feasible strategies. They identified similarities across high schools, which created an opportunity to implement strategies across sites.



Watch Brandywine's video on D&E pathways.

Ultimately, the teams **selected** four strategies that reflect the importance of beginning the recruitment process while students are in middle school.

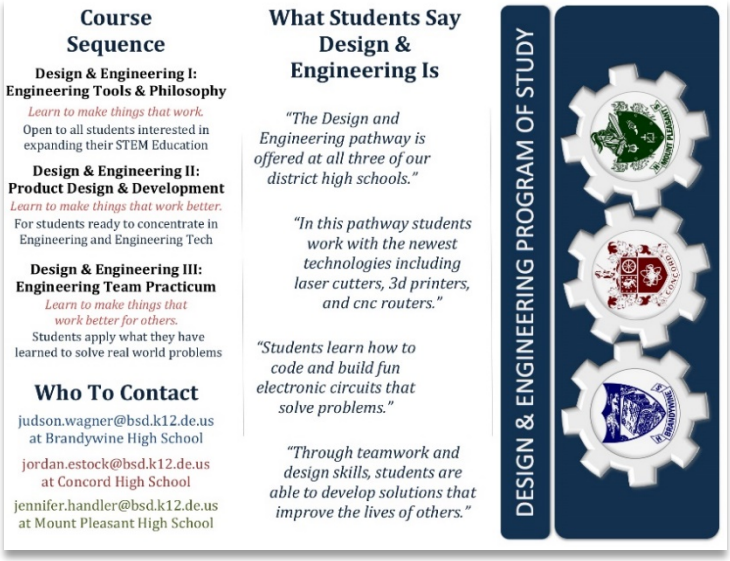
- Develop simple student-facing collateral to describe the D&E program and course sequence. Include students' quotes and their photographs to promote the program.
- Create a promotional video of the D&E program using student voices to use during recruiting events.
- Host a middle school outreach event at which female D&E students serve as role models and facilitators.
- Introduce the use of career interest inventory results by counselors to determine student scheduling in CTE career pathway programs.

The district matched 8th-grade students' Career Cruising Inventory results to course enrollment in the district's scheduling system. The process helped better identify nontraditional student candidates and present purposeful scheduling opportunities.

Act

The teams developed and **acted** on plans to implement the selected strategies. They used practical yet rigorous formative and summative measurements to evaluate their actions.

For example, the teams piloted an assembly about the D&E program with eighth-grade girls at Talley Middle School. During the assembly, they distributed their D&E program marketing flyer for counselors to use when conducting outreach with middle school students, premiered their promotional video, and hosted breakout sessions by feeder middle school and panels with female D&E students from each high school.



The BSD team's middle school event provided a low-risk environment for girls to learn about the D&E program from students that looked like them, which validated their sense of inclusion and relevance. This event fostered a sense of community that motivated future students to enroll in the program and current students to persist in it, serving to increase their self-efficacy.

A survey revealed that 82% of students felt better informed about the engineering pathway because of the assembly. In addition, students shared their plans to pursue the D&E pathway as a result of the assembly.

- **46% of the girls who participated** in the assembly enrolled in the pathway following the event.
- **Only 10% were "talked out of" enrolling** in the pathway.
- Concord High School reported that **16 female students** who attended the assembly said they wanted to pursue an engineering pathway.

We saw girls self-efficacy in engineering increase when they heard directly from their female schoolmates who both enjoyed and were successful in Design and Engineering. ~ Judson Wagner, Physics & Engineering Teacher

RESULTS

Student Outcomes

Following is a summary of BSD's performance gap analyses, action research into root causes and results.

Table 1 Performance Gap Analysis and Root Causes Research Results for D&E Program

High School	Gap by level* (Fall 2017 Enrollment)	Root Causes	Results (Fall 2019 Enrollment)
Districtwide	16.5% of students in D&E in the Technology Career Pathway are female.	Mismatches exist between student outcomes on Career Cruising interest inventory and their selected course work.	Participation increased at some levels at each high school and at all levels at Mount Pleasant.
Brandywine	Level 1: 24% female Level 2: 5% female Level 3: 17% female	Middle school teacher recommendations may introduce unintended bias into course/pathway selection process.	Level 1: 24% to 29% Level 2: 5% to 15% Level 3: 17% to 5%
Concord	Level 1: 30% female Level 2: 14% female Level 3: 12% female	Incoming freshman have a wide range of misconceptions about the pathway. The middle school experience matters. Parents play a part in students' career decisions. Marketing and information about the course are lacking. The first 2 weeks in the program are critical.	Level 1: 30% to 26% Level 2: 14% to 27% Level 3: 12% to 11%
Mount Pleasant	Level 1: 36% female Level 2: 24% female Level 3: 17% female	Majority of students have a relative or family member who is an engineer. Students do not receive enough information about courses and pathways in middle school. There is a lack of female engineering and science role models.	Level 1: 36% to 40% Level 2: 24% to 33% Level 3: 17% to 20%

Levels represent progression through the Engineering Technology Career Pathway.

PIPE Team Member Outcomes

Each team member completed a pre- and post-survey based on a four-point Likert scale. Surveys evaluated the impact of PIPE training on educator's capacity to implement effective solutions to increase student access, educational equity, and, ultimately, workforce diversity. Overall, the post-survey response weighted averages exceeded the pre-survey responses (difference ranged from -.02 to .81). Team members reported most significant increases in:

- **Knowledge about methods** to increase underrepresented students' participation and persistence in nontraditional courses and programs as well as strategies to evaluate intervention effectiveness;
- **Confidence in their ability to identify and address inequities** in the program, school, and/or classroom;
- **Intention to promote programs school or district-wide that inform students** of the value of taking nontraditional CTE courses; and
- **Belief that all students can succeed in nontraditional CTE programs**.

This last statement highlights an important goal of NAPE's PIPE program. We strive for educators to become aware of biases that may inadvertently lead them to discourage certain students from engaging in specific courses and careers, particularly nontraditional careers.

NEXT STEPS

The BSD team learned that power lies with data, which cannot be disputed. Whether related to demographics, course selection, or achievement, data are an important resource for educators to use to identify real issues. Only through a deliberate process—to identify gaps, uncover their causes, validate and understand the dynamics of those causes, and implement strategies to mitigate the causes—can an institution realize improvements they can sustain and even enhance over time.

As part of the continuous improvement process, the BSD team plans to refine and scale its efforts to recruit and retain underrepresented students in the D&E program and in other CTE programs.

I have continued with the Design and Engineering pathway throughout high school and I am currently working with my team on a Call Button device for assisted living facilities. I have thoroughly enjoyed my high school engineering experience and the pathway has helped me gain so much confidence as a student and a woman in a male-dominated field. I plan to continue my studies within the same pathway and eventually pursue a career in the STEM field . ~ Meredith Haines, Student

The National Alliance for Partnerships in Equity (NAPE), www.napequity.org, is a consortium of state and local education and workforce agencies, corporations, national organizations, and individuals. NAPE is dedicated to building the capacity of educators to use effective solutions to increase student access, educational equity, and workforce diversity.

NATIONAL ALLIANCE FOR PARTNERSHIPS IN EQUITY

91 NEWPORT PIKE, SUITE 302, GAP PA17527 | 717.407.5116 | NAPE@NAPEQUITY.ORG