



## **NSF S-STEM Scholarship Grant for Engineering and Applied Technology Majors to Increase Enrollment and Retention**

### **Dr. Kenan Baltaci, University of Wisconsin, Stout**

Kenan Baltaci is an Assistant Professor at University of Wisconsin-Stout, in the Electrical Engineering Technology Department. He received B.S. in electrical engineering degree from Istanbul Technical University in Turkey. Following, a master's degree and doctoral degree in industrial technology was granted from University of Northern Iowa.

### **Mrs. Melissa Thompson P.E. P.E., BridgeValley Community and Technical College**

Melissa Thompson is an Associate Professor at BridgeValley Community and Technical College, (formerly Bridgemont Community and Technical College), in the Civil Engineering Technology Department. She holds baccalaureate and masters degrees in Engineering, and is a Registered Professional Engineer in the state of West Virginia.

### **Bekir Zihni Yuksek, University of Northern Iowa**

Bekir Yuksek received Doctor of Technology degree in Fall 2013 and is currently working as adjunct professor at the University of Northern Iowa. Research interests include renewable energy, wind energy, wind turbines, solar panels, solar energy, and management of renewable energy.

# **NSF S-STEM Scholarship Grant for Engineering and Applied Technology Majors to Increase Enrollment and Retention**

## **Abstract**

Bridgemont Community and Technical College (BCTC) in Montgomery, West Virginia, was awarded a NSF S-STEM (NSF Scholarships in Science, Technology, Engineering, and Mathematics) grant \$600,000 (over five-year period) to establish the Bridgemont STEM Scholars program to increase: the annual, full-time enrollment of engineering technology and applied technology majors, the retention of and degree completion rates of participating STEM majors, and the number of graduated Bridgemont STEM Scholars who become employed in their field or continue their education. This paper shares the insights gained about retention and enrollment in engineering technology programs using student demographics, baseline data, and a survey conducted learn about impact of financial and academic barriers on student enrollment and retention during the grant-writing process. Demographics and baseline data shows that the communities served are disadvantaged, come from low-income families in West Virginia, require financial assistance, and require developmental courses upon enrollment. The survey conducted shows that 84% of students receive financial aid, 55% stated that a lack of funding delayed progress toward a college education, and 88% expressed concern over having sufficient funds for college. Further, 63% of students indicated that they work an average of 27 hours per week to supplement their income for college. Demographic, baseline, and survey data aided in writing a NSF S-STEM grant to sponsor the creation of the Bridgemont STEM Scholars program to address issues of retention and enrollment in BCTC's engineering technology and applied technology programs.

## **Introduction**

In 2011, the State of West Virginia projected that over 10,000 engineering and technician jobs will need to be filled by 2018<sup>1</sup>. Most community colleges in West Virginia, however, do not have the educational programming needed to transform the workforce from blue collar occupations to STEM careers. Students throughout the state consistently face academic and financial barriers that lead to low enrollment and student retention, causing students to take long periods of time to complete degrees. Because of such barriers, first-generation students cannot stay in college or complete degrees on time without working substantial hours during the school year.

In 2013, in response to the financial barriers many students in West Virginia face, Bridgemont Community and Technical College (BCTC) submitted a S-STEM grant application to the National Science Foundation (NSF) in which it proposed the Bridgemont STEM Scholars program to increase the enrollment of and to shorten the time to completion for students in its engineering and applied technology programs. The following are the program's objectives:

1. Increase the annual, full-time enrollment in targeted engineering technology and applied technology fields from 200 to 215 students by the end of the 2014-2015 academic year.
2. Retain 90% (of an annual cohort) of participating STEM majors from the first to the second year.
3. Achieve a degree completion rate of 80% of participating students within two years (after all developmental level courses have been completed).

4. Maintain a 95% employment placement and/or continuing education of graduating Bridgemont STEM Scholars in their field within six months of degree completion.

BCTC targeted nine majors for inclusion in the Bridgemont STEM Scholars program. Five are Associate of Science degrees, and four are Associate of Applied Science degrees.

***BCTC Demographics and baseline data.*** BCTC was a unique candidate for the NSF S-STEM grant for many reasons. Located in rural Montgomery, West Virginia, BCTC has a total enrollment of 1,107 students, and has accredited programs in civil, electrical, mechanical, computer and information technology, and drafting engineering technology. BCTC serves a five-county region, and primarily attracts rural students who commute. BCTC also serves disadvantaged communities: On average, 43% of BCTC students who attend “feeder” high schools are low-income, and over 65% of entering students require developmental (pre-college level) courses. Over 76% of students require financial assistance. Many students are the first in their families to attend college.

In 2011, over 20% of BCTC students were represented in the nine targeted majors included as part of the NSF S-STEM grant application. Of those, 42% were first-generation students and 8% were under-represented minorities.

***Financial and academic barriers.*** The financial and academic barriers that many BCTC students face was highlighted as part of the S-STEM grant application. In 2012, the primary investigators (PIs) conducted a survey of 130 BCTC students in the nine targeted majors. Survey data showed that financial concerns are a major deterrent to enrollment and retention. Even with financial aid, college is difficult to afford for many BCTC students. In addition to baseline data, the survey indicated that 55% of participants stated that a lack of funding delayed or slowed progress toward getting a college education, and that 88% expressed concern over having sufficient funds for college. The survey also found that 63% of participating students work during the school year (for 27 hours per week, on average), and that 89% expressed concern that employment prevents them from studying.

Several academic and social barriers prevented or delayed degree attainment. As BCTC is primarily non-residential, students may lack the supportive peer connections needed to persist and succeed<sup>2</sup>, are disadvantaged by living and working off campus, have low involvement in student activities, are provided fewer opportunities to meet with professors during office hours, and have difficulties course loads.

The Bridgemont STEM Scholars program was developed to address the financial, academic, and social barriers facing BCTC students. Through the program, scholarships assist students with financial needs, and cohort activities seek to counteract the isolation that contributes to low student engagement.

### **Development of the Bridgemont STEM Scholars Program Objectives**

In developing the primary objectives of the STEM Scholars program, the PIs closely examined regional and state-wide data on employment, retention, and degree persistence. For example, to create the objective of increased enrollment, we examined regional labor market data, which showed that the demand for graduates in STEM-related fields was large enough to justify increasing STEM enrollment at BCTC. In creating the objective of retaining 90% of STEM majors from the first to the second year, the PIs compared BCTC retention data with

state-wide retention rates. When we discovered that BCTC’s retention rates for targeted majors aligned with those for all West Virginia community and technical colleges (58% in 2004; see also Table 1), we were confident that the support of the STEM Scholars program could achieve a 90% year-to-year retention rate.

**Table 1. BCTC and STEN department enrollment, graduates, and year-to-year retention (2011)**

Major (*indicates new program)	Enrollment	Number of graduates (2011)	Students with GPA 3.0 or higher	Year-to-year retention	Avg. year-to-year retention 2008-2011
BCTC overall	1,107	160	-	49	49.81%
Civil Eng. Tech.	2	19	6	34	43.69%
Elect. Eng. Tech.	5	14	7	58	51.35%
Mech. Eng. Tech.	1	4	3	39	55.01%
Comp/Info. Tech.	3	8	1	32	42.94%
Comp. Draft/Design Tech.	9	5	3	67	62.12%
Diesel Tech.	4	14	5	49	42.02%
Electromech Instr*	4	--	-	50	-
Blasting Tech.*	1	--	-	58	-
Welding Tech*	9	1	0	33	-

The most severe problem faced by BCTC students was matriculating within four years. Local data showed that because of prerequisite courses (courses that over 65% of BCTC students must take), time to degree completion increased greatly. Add to this that students change majors, transfer, or drop out, and we sought to achieve a degree completion rate (after prerequisites) of 80%.

In developing the objective of maintaining 95% employment and continuing education rates, we examined graduation data of four engineering technology programs (civil, electrical, mechanical, and computerized drafting/design). Data showed that 86% of students continued their studies, 8% became employed in their field after receiving an Associate’s degree, and 2% became employed in a different field. It was therefore important that the quality of education and the resulting opportunities be maintained, and that BCTC graduates find employment and/or continue their studies at the same high rate.

**Activities on Which the Bridgemont STEM Scholars Program Builds**

The Bridgemont STEM Scholars program builds on and enhances the following services to provide personalized attention to STEM Scholars to support retention:

**Learning Lab.** The BCTC Learning Lab provides free, on-on-one and online tutoring services.

**Recruitment.** BCTC expanded its existing STEM outreach by marketing the STEM Scholars program to regional secondary students through participation in local engineering competitions, conducting outreach to area high school students earning EDGE (Earn a

Degree, Graduate Early) credit, and by offering targeted STEM recruiting throughout the region. STEM faculty play a major role in such recruitment activities.

**Summer bridge program in math.** As more than half of BCTC's entering students must complete developmental courses prior to beginning courses in their major field, BCTC provides an accelerated math summer bridge program, "Bridging the Gap," for incoming students.

**STEM seminar.** BCTC developed a non-credit, two-course STEM seminar that STEM Scholars take in lieu of the existing freshman seminar. The first-year seminar focuses academic issues, and the second-year seminar focuses on career placement. The seminars enable STEM faculty to maintain interaction, create consistent programming, and assess the progression of STEM Scholars.

**Career Services.** BCTC's Career Services counselor uses workshops on resume writing and interviewing within the STEM seminar. The counselor also schedules workshops for each targeted major to address local career opportunities and to provide individualized career assistance.

**Career Check.** BCTC has implemented a "Career Check" in which students must prepare for career readiness. The Career Check is comprised of meetings between the student, the Career Services counselor, the student's faculty advisor, and the student's industry mentor to ensure that the student has the resources and skills needed to pursue career opportunities after graduation.

## **S-STEM Project Management Plan**

As part of the S-STEM grant application to the NSF, BCTC developed a project management plan for the Bridgemont STEM Scholars program.

Specifically, the PI has the overall responsibility for project administration and interactions with the NSF. The PI is responsible for outreach, marketing, recruitment, online visibility, oversight of industry mentors, and event planning. Co-PI's are responsible for oversight of two advisory committees, reviewing applicants, evaluating and tracking STEM Scholars, data management, and reporting. The Dean of Technology at BCTC provides administrative oversight to the project, including the faculty and related projects.

Chairs of the Technology Department are responsible for administrating and teaching STEM seminars, and for scheduling guest speakers and visits to industry sites. They also recruit faculty advisers for STEM Scholars as well as industry mentors from the area.

## **Student Selection Process and Criteria**

Scholarships for the Bridgemont STEM Scholars program are awarded on a competitive basis. The program's Administrative Committee meets each spring to review and rank fall applications according to specific academic and administrative criteria, as outlined at <http://www.bridgemont.edu/index.php/stem-requirements>. Applicants must meet these criteria, submit an application, be interviewed, have completed any required developmental coursework, and be enrolled in one of the STEM academic programs. Top applicants are offered scholarships, and the amount of individual, unmet financial need is determined by BCTC's Financial Aid office.

## **S-STEM Student Support Services and Programs**

The following new student support services were developed for the S-STEM grant application to support the Bridgemont STEM Scholars program.

**Recruitment.** In addition to recruitment efforts already described, the Admissions Office and Communications/Marketing Department have worked closely with the PI to develop a marketing plan and promotional materials. BCTC has also promoted the program at local career centers and trade schools, and has nurtured its relationship with WVU Tech to improve the placement of STEM Scholars.

**Academic support.** A portion of the STEM tutoring center has been reserved for STEM Scholars. Study groups have been formed according to major and are staffed by a faculty member, making faculty more approachable to STEM students.

**Student cohorts.** The Bridgemont STEM Scholars program encourages cohort relations in many ways. In addition to study groups, STEM scholars taking the same STEM seminar meet once per month with the seminar's faculty member to address any needs. A social event is held at which STEM Scholars of all majors attend with industry mentors and faculty advisors.

**Industry mentors and faculty advisers.** STEM Scholars are assigned a faculty advisor and an industry mentor. Faculty advisers oversee the student's academic program and ensure that the student is on track for completing program requirements within two years.

Industry mentors participate at a ratio of one mentor per three students, and students meet in person with his or her mentor at the beginning of each semester and at the social event.

Subsequent semi-monthly meetings are held to provide guidance on career choices, summer internships, and personal and professional management.

**Summer internships.** BCTC has built on its successful summer job placement service by encouraging all STEM Scholars to apply for an optional STEM internship in their field during the summer between their first and second year.

## **Assessment and Evaluation**

To meet NSF S-STEM grant requirements, the Bridgemont STEM Scholars program developed a comprehensive evaluation that includes a formative evaluation performed each semester and an end-of-project summative evaluation. The formative evaluation examines program implementation and student outcomes to determine how well each of the program's components met participant expectations, helped achieve program outcomes, and how the program can be improved.

## **Summary**

The Bridgemont STEM Scholars program promotes STEM education in rural West Virginia by creating a program model that offers the following: (1) financial support to students; (2) accelerated math courses and individual tutoring; (3) cohort development for academic and social support; (4) STEM seminars that expose students to multiple technical disciplines and skills in college success and employment preparation; (5) frequent contact with industry mentors and faculty advisement; and (6) a summer internship between the first and second year.

Through this model, and through outreach that strengthens partnerships between community colleges and area industries, the program meets the needs of many first-generation college students in the region and helps to create a more educated workforce in West Virginia.

## References

1. ASTRA (2011). West Virginia's K-12 STEM Ed Report Card. *STEMConnector. The Alliance for Science & Technology Research in America*. Retrieved July 5, 2012 from <http://www.stemconnector.org/sites/default/files/sbs/ASTRA%20STEMEd%20WestVirginia%202011.pdf>
2. Deffendall, M., Knutson, N., & Sacks, D. (2011). *A profile on first-generation college students at the University of Kentucky: A focus on retention efforts*. Undergraduate Education White Paper. Lexington, KY: University of Kentucky. Retrieved June 23, 2012 from [http://uknowledge.uky.edu/cgi/viewcontent.cgi?article=1001&context=uge\\_reports](http://uknowledge.uky.edu/cgi/viewcontent.cgi?article=1001&context=uge_reports)