Progress Report on BE-TEC: An NSF S-STEM Project

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Abstract

Utah Valley University (UVU) was awarded an NSF S-STEM grant for $1.5 million dollars (over a six-years period) to strengthen outcomes for students in computer science and engineering through Leadership, Engagement, Academic Mentoring, and Preparation. This BE-TEC (Building Exceptional Talent in Engineering and Technology) scholarship program is a Track 2 scholarship program for students in Electrical Engineering, Computer Engineering, Computer Science, Computational Data Science, and Software Engineering. This paper presents the progress report of this scholarship program and its impact on the institution, its Computer Science and Engineering Programs, and the community. Also, it presents the effect of the high-impact practices in this program in retention of computer science and engineering students. High-impact practices reported include Capstone Courses, Collaborative Projects, First-Year Experiences, Internships, Undergraduate Research, and Writing Intensive Courses.

Introduction

The National Science Foundation (NSF) established the Scholarships in STEM (S-STEM) program in accordance with the American Competitiveness and Workforce Improvement Act of 1998, to address the national need to increase the number of American scientists and engineers [1]. S-STEM programs award scholarships to academically talented students who demonstrate financial need. S-STEM programs are designed to increase the number and diversity of students entering science and engineering programs as well as to retain more students in their STEM programs through graduation and to improve the quality and preparedness of graduates entering the science and engineering workforce.

The Smith College of Engineering and Technology at Utah Valley University (UVU) was granted an S-STEM Track 2 scholarship program for students in Electrical Engineering, Computer Engineering, Computer Science, Computational Data Science, and Software Engineering. This program is advancing Utah's Engineering and Computer Science Initiative, contributing to a high-quality STEM workforce, and strengthening programs at a large, open-admissions university. The BE-TEC scholarship program is building on the success of a previous S-STEM Track 1 program [7] by:

1) promoting student success and degree completion through scholarships to low-income, academically promising students, beginning in their freshman year.
2) implementing evidence-based activities to support scholars including intentional faculty mentoring, high impact practices, and professional preparation.
3) advancing knowledge about evidence-based, context-specific interventions for STEM programs at primarily undergraduate institutions. BE-TEC is increasing support of financially needy students with an interest and aptitude for engineering and computing degree programs by offering an average of 23 scholarships per year over a six-year period to at least 43 unique students.

This project, now in its third year, is increasing the graduation rate for students in Computer Science and Engineering at UVU, an open enrollment university, and better preparing them for continued education and/or success in the STEM workforce by providing scholarships to academically talented students with financial need and by providing leadership opportunities, engaged learning activities, and mentoring. Up to now, thirty-four students meeting the selection criteria have been recruited and awarded scholarships.

Background Information

UVU is a comprehensive regional university with over 43,000 students charged with serving Utah County, which is the second largest county in the state. UVU has a dual mission – that of a comprehensive university offering 91 bachelor's degrees and 11 master's degrees, and that of a community college offering 65 associate degrees and 44 certificate programs. To fill its community college mission, the institution maintains an open-enrollment policy. To facilitate academic robustness, UVU has implemented a structured enrollment policy that establishes requirements which students must meet before they can engage in all the courses of their major and provides additional access to advising and other resources. These additional preparatory courses increase students' time to graduation but help them succeed. As a large public university, UVU has a very high number of low-income students – the largest proportion in the state [2]. Around 21% of students are classified as non-traditional students (age 25 or older). Nineteen percent of the students have children under the age of five [2]. UVU's students live at home or in off-campus housing, which makes it very difficult to organize activities for them. Many students do not have time to spend much time outside of class on campus, leading some to feel little connection with other students. About 80% of UVU's students will remain in their communities and pursue employment in this region [3].

Utah County has been one of the fastest growing regions in the country with more than 96% growth between 1990 and 2010-time period [4]. Because of this huge growth, UVU has undergone multiple transitions since its origin in 1941 and has expanded its mission and role within the region. In 1987, it was a community college. The institution became a state college in 1993 and a regional university in 2008. In fall 1993, the enrollment was 10,500 and tripled in fall 2012 to 31,500. The demand for education has been met by an increase in baccalaureate degrees offered from three in 1995 to 91in 2020 in addition to eleven master programs as well as 65 associate degrees. This required institutional transition has strained state and community resources and created several challenges, particularly in the availability of scholarship funds.

Engineering and Computer Science Departments

To meet one of the region's most pressing workforce needs, UVU initiated three new engineering programs in Fall 2018. The new bachelor's degree programs in Electrical Engineering, Civil Engineering, and Mechanical Engineering have joined UVU's established programs in Computer Engineering and Pre-Engineering in a new Department of Engineering. The new programs were immediately popular with students, with 300 students enrolling for Fall 2018. Currently, the new Engineering Department has more than 900 students in five programs which are housed in that department. Before forming the Engineering Department at UVU, Computer Engineering program was housed in the Computer Science department which offers a Bachelor of Science (BS) in Computer Science, Software Engineering, and Computational Data

Science. It also offers a Bachelor of Applied Science in Software Development and a Master of Computer Science. The Bachelor of Science in Computer Science program was one of the first Bachelor of Science programs implemented at UVU in 1993. The program's goal has been to provide a quality program that meets accreditation standards while providing the students with a skill set that allows them to succeed in computing careers. The Computer Science degree at UVU is accredited by Computing Accreditation Commission of the Accreditation Board for Engineering and Technology (ABET). Currently, the Computer Science Department has more than 1300 students. The Engineering programs at UVU are accredited by Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology.

Tables 1 and 2 show the enrollment and graduation trends in the Computer Science and Engineering programs. As can be seen from the tables, the number of students has continued to rise over the past six years for most of the programs, however, the graduation rate remains low. Many students, particularly juniors and seniors, work over 20 hours a week to support their families while attending school, thus slowing down their progress and delaying their graduation. Most of our students are married and have several children. These students often leave their programs of study early to accept employment in an industry anxious for employees. The Utah Department of Workforce job forecasts and other job trends surveys indicate that while these students can earn strong salaries without degrees, their careers will not advance as they would with degrees [5]. Employers are also feeling the disadvantage of too few job candidates with the adequate training provided by a baccalaureate degree [6]. The lack of adequate number of scholarships in Computer Science and Engineering programs is a significant inhibitor in graduating and enrolling more students.

Program	Enrollment Numbers					
	2017-2018	2018-2019	2019-2020	2020-2021	2021-2022	2022-2023
Computer Science	1352	1385	1343	1,288	1,283	1,185
Computer Engineering	283	265	209	199	176	152
Software Engineering	206	233	230	280	271	292
Electrical Engineering	-	74	127	142	186	190

Table 1: Enrollment Numbers in Computer Science and Engineering Departments

Program	Graduation Numbers					
	2017-2018	2018-2019	2019-2020	2020-2021	2021-2022	2022-2023
Computer Science	64	92	115	129	105	122
Computer Engineering	13	8	20	15	14	4
Software Engineering	12	23	15	22	24	23
Electrical Engineering	-	-	2	3	7	11

Table 2: Graduation Numbers in Computer Science and Engineering Departments

BE-TEC Project Goal and Objectives

The goal of the BE-TEC project is to build on the success of a previous S-STEM program to increase the graduation and retention rates for students in Engineering and Computing at UVU and develop their potential for success in the STEM workforce by providing scholarships to academically talented students with financial need and by providing evidenced-based support and activities to include intentional faculty mentoring, engagement in high-impact practices, professional preparation, and leadership opportunities [7].

The Process objectives of the BE-TEC project are to:

1. **"Scholarship Awards** - Increase support of financially needy, but academically talented students (including students from underrepresented groups) with an interest and aptitude for engineering and computing degree programs by offering an average of 23 scholarships per year over a 6-year period to at least 43 unique students.

2. **Intentional Mentoring** - Support scholars' academic growth with faculty mentors who emphasize the use of an Individual Education and Development Plan to foster student growth and increase student outcomes for persistence, completion, and career aspirations.

3. **Engagement in High Impact Practices** - Engage scholars in high impact practices, including capstone projects, internships, and collaborative projects.

4. **Professional Preparation** - Foster professional preparation through common academic coursework, skills workshops, guest speakers and career awareness presentations, field trips to industry, and conference participation and presentation.

5. **Leadership Opportunities** - Provide leadership opportunities for all scholars within a student section of a professional organization (IEEE) or club (BE-TEC Club)". [7]

The Measurable Outcome Objectives of the BE-TEC project is:

A. **"Graduation** - A minimum of 20 scholarship recipients will graduate with a baccalaureate degree in EE, CE, CS, or SE by the end of year six. (18 will still be enrolled)
B. **Completion and year-to-year persistence rates of BE-TEC participants** will show an increase from the departmental baseline and a comparison cohort.
C. **Employment in STEM Workforce** - A minimum of 95% of BS degree graduates will be employed in a STEM field or enrolled in graduate school within in 6 months after graduation.
D. **Advance Knowledge** about the use of internships to learn relevant job skills, increase social and communication skills, and improve employment outcomes (salary & jobs in field). Two papers on the results of the program will be submitted and presented at conferences". [7]

BE-TEC Program Management Plan

As part of the BE-TEC grant application to the NSF, UVU developed a project management plan for the BE-TEC S-STEM scholarship program. Specifically, the PI has the overall administrative responsibility for the project and for interacting with NSF. She coordinates the activities of the Project Management Team, including such activities as advertising and recruitment of students, selection of students, maintenance of BE-TEC records, and oversight of student support services. She has the fiscal oversight and reporting responsibilities for the project. Co-PI's were responsible for conducting selection of scholarship recipients, ensuring that recipients understood their obligations to the program, assigning mentors, meeting with students regularly, and monitoring their progress [7].

BE-TEC Scholar Selection Criteria

Students were selected based on the following criteria:

1) U.S. Citizen, Permanent Resident, US nationals, or admitted refugee.
2) Demonstration of low-income (defined at UVU as Pell Eligible); and have unmet financial need in accordance with the Department of Education FAFSA rules.
3) Demonstrate academic ability or potential.
4) Full-time student majoring in Computer Science, Computer Engineering, Software Engineering, Electrical Engineering, or Computational Data Science.

BE-TEC Scholar Agreement

The selected BE-TEC Scholars were committed to progressing in their major by signing a contract with the institution. This contract set out their requirements to accomplish the following:

1) Maintain a grade point average of at least 3.0 in all classes taken.
2) Meet with their faculty mentor twice per semester (monthly for the first year) and create an Individual Education and Development Plan (IEDP).
3) Participate in common coursework to the extent possible
4) Attend the initial meeting and two monthly BE-TEC meetings each semester.
5) Participate in the IEEE student section or CE club (participants will be urged to accept leadership roles)
6) Complete an internship course in their junior or senior year.
7) Scholars will also agree to participate in ongoing project evaluation.

Scholars required out-of-class time commitments are not going to be extensive and focus on the most important activities for program coherence and student success. The most important element of the scholar contract is academic performance. Thus, there are some options and flexibility to allow the BE-TEC scholars with other responsibilities to reasonably participate in the activities.

High Impact Practices (HIPs)

High-impact practices (HIPs) are specific active learning practices that educational research has shown to increase rates of student retention and higher levels of learning success [8]. HIPs are innovative and transformational learning opportunities for students inside and outside of the classroom that provide a variety of learning benefits aimed at promoting the success of students. Student success is the core objective of any institution of higher education. There are ten types of high-impact practices endorsed by the Association of American College and Universities (AAC&U) and George Kuh. In an AAC&U report, Kuh describes a strong positive effect of participating in high-impact activities as measured by the National Survey of Student Engagement (NSSE) [9]. Kuh identified the following ten learning experiences as high -impact educational practices which research has shown benefit students of many backgrounds [10]:

- First Year Seminars and Experiences
- Common Intellectual Experiences
- Learning Communities
- Writing-Intensive Courses
- Collaborative Assignments and Projects
- Undergraduate Research
- Diversity/Global Learning
- Service Learning, Community-Based Learning
- Internships
- Capstone Courses and Projects.

Kuh recommends that to increase student engagement and student success, every student should participate in at least two HIPs during their academic career, but ideally every student should participate in one HIP each year in college. Subsequent research built upon Kuh's work identified an eleventh practice which is E-Portfolios. As Kuh's report stated, "These practices take many different forms, depending upon learner characteristics and on institutional priorities and contexts" [8]. Kuh and O'Donnell elaborate this consideration in their 2013 book, "Ensuring Quality and Taking High-Impact Practices to Scale" [9]. Following is list of eight characteristics of impactful HIPs:

- Performance expectations set at appropriately high levels.
- Significant investment of time and effort by students over an extended period.
- Interactions with faculty and peers about substantive matters.
- Experiences with diversity, wherein students are exposed to and must contend with people and circumstances that differ from those with which students are familiar.
- Frequent, timely, and constructive feedback.
- Periodic, structured opportunities to reflect and integrate learning.
- Opportunities to discover the relevance of learning through real-world applications.

- ❖ Public demonstration of competence.

While not all HIPs address each element to the same degree, the list provides a standard for judging the quality of implementation. It could potentially be used to assess the quality of other evidence-based curricular and co-curricular activities as well.

The most common outcome studied across all high-impact practices is student retention and academic performance (grade point average). For both measures the result is positive: students who participate in HIPs are consistently retained in the programs at a higher rate than those who do not. HIPs have a positive impact on student performance.

High Impact Practices in NSF BE-TEC Program

Of the ten types of HIPs endorsed by Kuh and AAC&U [10], six HIPs were employed by the BE-TEC program which are: Capstone Courses and Projects, Writing Intensive Courses, First-Year Experiences, Collaborative Projects, Undergraduate Research, and Internships. Table 1 shows the structure of HIPs within the BE-TEC program. A discussion of the implementation of each HIP and high-impact activity follows Table 1.

Year in bachelor's degree Program	Type of High-Impact Practice (or activity)	Method	Implementation
1st year	First-year course Collaborative project	Curricular Co-curricular	Encouraged - optional Support by BE-TEC
2nd year	Collaborative project	Co-curricular	Support by BE-TEC
3rd year	Collaborative project Internship Undergraduate research	Co-curricular Curricular Co-curricular	Support by BE-TEC Required Required Encouraged - optional
4th year	Capstone course & project Writing intensive course Undergraduate research	Curricular Curricular Co-curricular	Required, BE-TEC Support Required Encouraged - optional
All years	Faculty mentor Leadership opportunities	Co-curricular Co-curricular	Required for BE-TEC Optional; Encouraged

Table 1: Application of HIPs in UVU's BE-TEC Program

First-Year Experiences

Several first-year experiences were available to students in the BE-TEC program. First, BE-TEC students were asked to take CS 1400 (Object Oriented Programming) which is a basic required course for all majors in the program together. This was planned as a community-building element for first-year students. However, students had such differing scheduling requirements that getting all or even many of first-year students into one section of the course was not feasible

(tried to put as many as possible in the same section). However, as the engineering programs progressed, the ECE 1000 (Introduction to Electrical and Computer Engineering) course was redesigned as first-year experience. For the ECE scholars in the program, the freshman students were given oscilloscope training boards to use for conducting small projects [14].

While these courses are not exclusive to students in the BE-TEC program, they did provide a meaningful HIP experience to BE-TEC students at the beginning of their program of study. The faculty on the CE/EE curricular design teams included members of the BE-TEC project team and addressed BE-TEC project goals. As described in High-Impact Educational Practices [10] these first-year experiences brought small groups of students together with faculty on a regular basis and placed strong emphasis on critical inquiry, information literacy, collaborative learning, and other skills that develop students' intellectual and practical competencies. HIP characteristics they emphasized were: "interactions with faculty and peers about substantive matters;" "experiences with diversity;" and "opportunities to discover relevance of learning through real-world applications." Importantly, BE-TEC students in all programs used the Computer and Electrical Engineering Lab to work collaboratively on their projects. Moreover, faculty mentors provided support to BE-TEC students in the introductory classes by answering questions, monitoring student progress, and directing students to tutoring as needed. This program element also demonstrates that successful S-STEM projects can and should integrate and coordinate with departmental/institutional resources [14].

Collaborative Projects

The NSF BE-TEC activities became the strongest community-building element in the program. It was planned that within these BE-TEC activities, one collaborative project would take place each semester, hosted by the BE-TEC Club and/or the UVU IEEE Student Section. The projects were sponsored by BE-TEC but included both scholarship and non-scholarship recipients. Projects were chosen that would allow both computing and engineering students to work collaboratively. For example, for one project, students took a bicycle and designed it to be an e-bike with sensors and a user console. Last year, students designed a game board. This year, they are working on a drone. The collaborative projects were multidisciplinary as they generally involved BE-TEC students from the targeted disciplines. The projects also involved students from all grade levels, which proved to be beneficial because upper-class students mentored first- and second-year students. For example, a senior student in the BE-TEC program who is working on a project which is sponsored by the state in fault detection and location in wind turbines using drones has set up a workshop on drone design and programming for the students in both departments using a drone that is purchased through the BE-TEC program. The projects were an excellent way for BE-TEC students to build a sense of community. They also provided a HIP opportunity for students in their middle years of college [14].

Internships

BE-TEC program requires all the participants to take an internship course. In our engineering and computing programs, an internship course is accepted as an elective course. While the various schools and colleges of the university have long had internship coordinators specific to their programs, internships at UVU are now coordinated through Internship Services in the Office of Engaged Learning (OEL). In 2017, in conjunction with UVU's Title III project, OEL centralized the coordination of internships to ensure that all meet the criteria of an HIP so that student experience with internships across all programs would be of high quality [12]. The Internship Coordinator for CET supports a website that details internship opportunities for each degree program. It sets forth clear procedures for students in initiating, completing, and receiving credit for an internship. An essential tool of the program is a six-part course on *Canvas* (UVU's Learning Management System). The course requires a learning agreement with five student goals, progress reports, a final report, a student survey, a supervisor survey, and a log for hours worked (60 hours per credit) [7]. A faculty member of the BE-TEC project team generally oversees the internship courses. As now designed, the internships include all eight key characteristics of impactful HIPs. They are particularly strong in "opportunities to discover relevance of learning through real-world applications;" "significant investment of time and effort by students over an extended period;" and "periodic, structured opportunities to reflect and integrate learning." [14]

Capstone Projects

Capstone courses play a crucial role in Electrical and Computer Engineering curricula. The principal purpose of a capstone project is to offer a summative opportunity for graduating senior engineering students to apply their professional skills and knowledge in a single experience and prepare them for work in industry. When the BE-TEC project began, students conducted their capstone projects in a one-semester capstone course. In recent years, like many engineering programs, students at UVU now complete their requirements for graduation with two semester-long capstone design project courses. The intention of these courses is to apply competencies gained during students' first three years toward the solution of a design problem. As the students are required to design, build, and troubleshoot a fully functional project, they find these courses both challenging and rewarding. These projects have been very successful at integrating knowledge and preparing students for the workforce [14].

Capstone projects include all eight key characteristics of impactful HIPs. Among the most prominent are: "performance expectations set at appropriately high levels;" "significant investment of time and effort by students over an extended period;" "frequent, timely, and constructive feedback;" and "public demonstration of competence." This public demonstration has been a presentation to faculty and students in the CE/EE or CS/SE departments, but this year, the CE/EE Advisory Board, representatives from industry, and the public were also invited to broaden the outreach of these presentations. Because capstone projects are a required part of the curriculum, all BE-TEC students who graduated participated in this high-impact practice. The BE-TEC program provides support for the capstone projects through faculty mentors, materials

for projects (which students otherwise might pay for themselves or chose a less suitable project), and workshops on essential skills. The BE-TEC program also pays for some students to present the results of their projects at professional conferences, and faculty mentors worked with them to prepare papers for publication. Last year, one of the BE-TEC scholars presented his work at the 2023 ASEE Annual Conference.

Writing Intensive Courses

The capstone courses are writing-intensive courses. As UVU sought to incorporate more HIPs into the curriculum, each department was charged with designating two required courses as Writing Intensive Courses. The Writing Enriched Committee recommended that faculty of these courses need to intervene in students' writing processes by providing in-class instruction, guiding feedback on plans and drafts, and engaging in one-to-one conversations with students about writing. Key HIP characteristics of the writing intensive courses dovetail with the capstone projects but reinforce "interactions with faculty and peers about substantive matters" and "periodic, structured opportunities to reflect and integrate learning." Students in the Capstone Courses submit weekly reports (low-stakes writing) and a very detailed technical report at the end of the semester (high-stakes writing). They are required to work with tutors from the Writing Center on their end-of-semester reports. They also receive feedback from faculty and other students [14].

Undergraduate Research

All BE-TEC students can participate in faculty-mentored undergraduate research activities outside of their capstone project if they choose to do that. One state funded, entitled *Utah System of Higher Education (USHE) Project* has provided paid mentored research opportunities to three BE-TEC students. These undergraduate research projects were strong in the key HIP characteristics of "performance expectations set at appropriately high levels;" "significant investment of time and effort by students over an extended period;" "frequent, timely, and constructive feedback;" and "public demonstration of competence," as students worked with faculty mentors to prepare conference presentations and papers. Faculty researchers, in coordination with the S-STEM team, could be encouraged to implement key HIP characteristics into the structure of their undergraduate research projects [14].

Faculty Mentors

Faculty mentors are not listed among the recognized HIPs, but they are recognized as an invaluable aspect of successful undergraduate STEM programs. Studies have shown that early and consistent interaction with a faculty mentor makes the transition to college smoother, increases academic success, and increases year-to-year persistence, especially for women and students from underrepresented groups [13]. One of the objectives of the BE-TEC program was to provide a faculty mentor to each program participant. Each NSF BE-TEC scholar is assigned a faculty mentor. Four faculty members served as mentors to BE-TEC participants. Typically,

students are introduced to their faculty mentors at the Meet Your Faculty Mentor Night conducted each September. Faculty mentors generally meet with their students every semester and more often if needed. Faculty mentors advise BE-TEC students about educational success, degree progress, potential fields of interest, career preparation, job seeking, and graduate school preparation. They connected students to tutoring resources as needed, and to various academic and career opportunities, such as research or internships. Key HIP characteristics the mentor/student relationship were "interactions with faculty about substantive matters," and "frequent, timely, and constructive feedback." [14]

Leadership Opportunities within a Professionally Focused Student Organization

Although not an acknowledged HIP, leadership opportunities within the IEEE student chapter or the NSF BE-TEC Club are an impactful activity of the BE-TEC program. BE-TEC students serve in positions of President, Vice President, Social Media Chair, VP of Publications, and VP for University Relations. BE-TEC enrichment and professional development activities were delivered largely through these organizations, which gave other students in the departments an opportunity to benefit as well. Under faculty supervision, student leaders took responsibility for planning BE-TEC activities, inviting and introducing guest speakers, arranging for field trips to local industries and employers, hosting or conducting workshops, and organizing BE-TEC design (collaborative) projects.

Key HIP characteristics this activity emphasized were "interactions with peers and faculty about substantive matters," "experiences with diversity," and "public demonstration of competence." Since student leadership was an optional activity, students' time commitment varied, depending on their position, the activity, and their availability.

Major BE-TEC Program Engagement Activities

One of the goals of this program is to increase the retention rate of the students in the computer science and engineering programs by providing engaged learning opportunities, high impact practices, and enrichment activities. The scholarship recipients are participating in interdisciplinary engaged learning opportunities through the BE-TEC club and IEEE student section projects, a required for-credit capstone project, a required internship, and faculty mentored research. Enrichment activities included leadership training and opportunities, two BE-TEC meetings each semester, involvement in student professional organizations or other student service organizations, field trips, Guest Speakers, networking opportunities, and faculty mentoring.

NSF BE-TEC Student Support Services and Programs

The BE-TEC program uses some of the student support services within the College of Engineering & Technology, including academic advising and tutoring for math, writing, engineering, and computer science (supplemented by specialized CE/EE & CS/SE tutors funded by this program). University-wide resources that are used include assistance with employment

and admissions to graduate school, and I Am First program for first generation students. In addition, the BE-TEC program is extending or adapting successful evidence-based practices from its Track 1 program. The planned support services and programs have been selected to increase academic learning, completion, and career or graduate school placement, as well as to assist in soft-skills development which is so important for graduates such as communication, teamwork, self-efficacy, leadership, and knowledge integration.

NSF BE-TEC Program Assessment

To assess the outcome of our NSF BE-TEC program, a study has been started by the institution's Business Intelligence and Research Services to compare the NSF BE-TEC students to two control groups:

- UVU students majoring in BE-TEC programs and NOT receiving BE-TEC scholarships.
- UVU students at large.

The comparison groups are formed by matching the NSF BE-TEC scholars with nonrecipients who are also attending during the first semester they received the scholarship. The comparison groups are randomized and then matched by major, gender, age, class level (credit hours completed), first generation status, and race/ethnicity. In addition to forming comparison groups, a telephony survey of BE-TEC participants is conducted every year. Another telephony survey is conducted after a student graduates.

NSF BE-TEC Scholarship Report

Thirty-four NSF BE-TEC scholars in six different STEM programs at UVU have participated in the NSF BE-TEC program up to now. Table 3 lists students from different programs that participated in the NSF BE-TEC program.

Programs	NSF Scholars
Computer Engineering	2
Computer Science	11
Software Engineering	6
Electrical Engineering	13
Computational Data Science	1
Software Development	1
Total	34

Table 3: Number of Scholars from Different Programs

Scholarships were first awarded in January 2022. A total of 34 students have received scholarships. Of those, 9 (26%) scholars have graduated with BS degrees (five graduates in Electrical Engineering, three graduates in Software Engineering, one graduate in Computer Science). Of the two scholars who have left the BE-TEC program: one was dropped from the scholarship program because he had low grades, and the other scholar changed his major to a non-STEM field. There are only two female students in the program (5.8%). The BE-TEC team is working to recruit more female students in the program. Many of the BE-TEC scholars are participating in undergraduate research which resulted in five capstone presentations at the I-ETC Conference and one presentation at the 2023 ASEE conference.

Impacts of the NSF BE-TEC Program

The financial benefits to students who are receiving the NSF BE-TEC scholarships are tremendous: the scholarships help students attend school, focus on their schoolwork, get better grades, complete their degrees, and complete them more quickly. The benefits of the BE-TEC projects support activities were also invaluable to students in retaining them in the program and better preparing them for their careers or continued education. The leadership and internship experience that they get in this program is very helpful in finding better paying jobs and prepare them for job interviews. Overall, this program provides an excellent opportunity for students in the engineering and computing programs toward an on time successful graduation.

Conclusion

This paper is a presentation of the progress report of UVU's BE-TEC program which is an NSF supported S-STEM project whose goal is to enable academically talented and financially needy students to pursue college degree in computing sciences and engineering. This program, now in its third year, is increasing the graduation rate for students in Computer Science and Engineering at Utah Valley University, an open enrollment university, and better preparing them for continued education and/or success in the STEM workforce by providing scholarships to academically talented students with financial need and by providing leadership opportunities, engaged learning activities, and mentoring. Overall, the BE-TEC program is an effective tool in helping to recruit, retain, and promote computer science and engineering programs.

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