New Orleans JAZZED about Engineering Education

Paper ID #16903

Building Capacity to Strengthen Student Success

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Building Capacity to Strengthen Student Success

Introduction

Undergraduate student retention and graduation rates are, and have been for many years, frequently discussed topics within the higher education community[3]. In addition, there has been significant national attention on STEM education and ensuring that the country has enough qualified individuals to meet workforce needs[1, 2]. This, too, has led to a closer examination of college retention rates due to the demand to produce more graduates in these fields.

For many institutions, that means finding creative new ways to tackle this entrenched and many-headed monster that is retention. The reasons for student attrition are complex and varied, and therefore, it stands to reason that the solution (or solutions, more likely) must also be multi-pronged.

For an interdisciplinary team of faculty and staff at the University of Wisconsin-Platteville (UW-Platteville), this meant seeking grant funding to support several new and modified initiatives in the College of Engineering, Mathematics and Science (EMS). UW-Platteville is a medium-sized, primarily undergraduate, public institution with a total undergraduate enrollment of approximately 8,000. Many of the university's STEM degree programs, including seven engineering programs, computer science, and chemistry, are housed within the College of Engineering, Mathematics and Science (EMS), which has an enrollment of approximately 2,700 students. In 2013, the team obtained a National Science Foundation STEP grant (#1161180 College of EMS Recruitment and Retention Program). The primary purpose of the grant is to increase undergraduate student engagement and to plan, market, and advance programs that support recruitment and retention efforts in STEM disciplines with special efforts toward women and underrepresented student populations.

The initiatives developed through the grant include a retention center learning space; career exploration industry partnerships; undergraduate research and travel; peer advising; peer mentoring; and pre-college outreach.

Implementation & Assessment

Retention Center Learning Space

As part of the grant initiatives, a study and resource space was created within the College of EMS. A classroom in one of the two engineering academic buildings was identified and approved by university administrators for the center's location. An interactive forum was held in the spring of 2013 in the classroom that would be the future location of the center in order to gather input from students before constructing the space.

The room, named CenterPOINT (Center for Projects, Opportunities, Instruction, Networking, and Teamwork), was remodeled over the summer of 2013, incorporating the feedback received at the forum. Upon its opening, CenterPOINT included such features as: a full-time academic

advisor/center manager; a front desk staffed by student assistants; free drop-in peer tutoring hours; tables on wheels that could be easily moved into different configurations; five computer stations; items available for checkout such as phone chargers, headphones, and calculators; a kitchenette space with refrigerator, microwave, and sink; wall-mounted and mobile white boards; soft seating; and cubby storage for books and personal belongings. The space comfortably seats approximately 34 people.

The student staff attend regular training and development meetings to help them acquire professional skills and to ensure that the quality of service provided at CenterPOINT is exceptional. Staff development topics include understanding how to effectively work with and serve individuals from diverse backgrounds, recognizing and reporting bias incidents, and creating a welcoming and inclusive environment.

Improvements to the space are continuously made as students voice their suggestions. In semesters after the space opened, several components were added including: availability of engineering paper; a single-serve coffee brewing machine; a collaboration station where multiple students can plug in laptops and display their screen on a large monitor; laptops available for check out; dual monitors on the computer stations; and rotating art pieces from the campus's permanent gallery collection.

To assess the effectiveness of the space, user demographics are collected and analyzed. Table 1 shows usage of the space in CenterPOINTS's first two complete academic years. These unique user numbers represent approximately 30% of College of EMS students in 2013-14, and approximately 35% in 2014-15.

Table 1: CenterPOINT Visitors

Year	Visits	Unique Visitors	Average Visits per Visitor
Academic Year 2013-14	12,932	816	16
Academic Year 2014-15	13,956	933	15

In 2013-14 overall, 29.4% of visitors were female. This is significantly higher than the percentage of women enrolled in the College of EMS overall, which was 14.3% in the 2013-14 academic year. In 2013-14 overall, 11.5% of visitors were underrepresented minority students as compared to 8.5% underrepresented minority students within the College of EMS as a whole.

Other measures include retention of the CenterPOINT users and their grade point averages as compared to their peers who do not use CenterPOINT. Students who use CenterPOINT retain to their next year of education at a rate of 86.6%, as compared to 73.7% of their peers who do not utilize the space. This difference is significant with a p-value of 0.000, using a two proportions hypothesis test.

Students who utilize CenterPOINT have cumulative GPA's that average .24 higher than their peers who do not use the space. CenterPOINT users' term GPA's are .27 higher on average (Table 2). Both results are statistically significant at a .01 significance level.

Table 2: CenterPOINT Visitors' Grade Point Averages

	Cumulative GPA	Term GPA
CenterPOINT Users	3.06	2.93
CenterPOINT Nonusers	2.82	2.66

Career Exploration Industry Partnerships

Many students are motivated by their long-term career goals, but may not have an awareness of the full breadth of career possibilities, or may not have realistic expectations about the working world in their chosen field. By partnering with industry, the STEP grant has been able to offer industry-led workshops on campus and also coordinate trips to corporate locations so that students can gain exposure to the working world and build their professional networks. Companies benefit from these opportunities as well. These interactions with current college students serve as an excellent way to build recognition for their company and grow their pipeline of future employees.

For the on-campus workshops, company representatives work with grant staff to determine appropriate topics and send representatives to campus to present. These workshops are free for students to attend and typically include a meal sponsored by the presenting company. For the trips, company representatives work with grant staff to coordinate travel. The trips are free for students to attend, and typically include facility tours, panel discussions, and a meal sponsored by the presenting company. Depending on the location of the company's facility, they may also cover the cost of transportation and/or overnight accommodations.

Marketing and advertising of these opportunities are done in collaboration with the Office of Multicultural Student Affairs and the Academic and Career Advising Center in order to ensure that all populations on campus are being reached.

In the first two academic years of the grant, nine workshops and trips were coordinated with seven different companies. One hundred and sixty-six unique students participated in these events. A survey is issued to student participants after the experience. Ninety-one percent of participants who took the survey agreed that the experience helped them gain a better understanding of career paths within their field of study. In addition, one hundred percent agreed that the experience was worth the time to attend.

Undergraduate Research and Travel

Another initiative of the STEP grant has been to implement an Undergraduate Research & Travel Grants program to support College of EMS students who are working on independent research and/or who wish to travel to professional conferences. These high-impact practices are essential

to providing a rich college experience to students. Students who wish to receive support must submit a proposal application, which is then reviewed by a committee. The committee has developed a scoring rubric to ensure a fair and transparent review process of all applications.

In the first two years of the program, support has been provided to 94 students. Funded research projects have included Separation of Chlorella from Growth Medium; Gene Expression Analysis of the p38 Inhibitor; Response of a Three Mass System in Ocean Waves; Cell Death in Human PBMC, Humidity Effects on Microscopy Measurements; Treatment of Drinking Water in a local community; and a feasibility study of solar power in public buildings in a local community. Funded trips have included the American Society for Biochemistry and Molecular Biology conference; Society of Women Engineers conference; National Conference on Undergraduate Research; American Society of Civil Engineers conference; American Chemical Society conference; travel to Haiti for a solar panel installation project; and travel to Ghana, Africa, for the construction of a school.

As a condition of the funding support, students are asked to disseminate their research findings or knowledge gained at conferences on the campus community. This helps to encourage other students to pursue similar opportunities. Student participants also write a reflective summary of how the experience enhanced their classroom learning. Representative anecdotal quotations from some of these reflections are included here:

- "The experience was incredible. I was exposed to elements of the civil engineering world above and beyond what I could learn in a typical classroom setting."
- "This research will allow me to apply what I have learned in the classroom. Many students are helped by the services that CenterPOINT provides and I am pleased to consider myself one of those students."
- "I am deeply honored to be a recipient. I look forward to this experience. I have long been interested in working to improve the lives of others."

Peer Advising

Peer advising is a STEP grant initiative that was implemented in the College of EMS during the fall 2014 semester. The purpose for peer advising is for experienced upper-class students to assist their near-peers during the course selection and registration process. This can be especially useful to first generation college students, who may be unfamiliar with the course selection and registration process. Peer advisors serve as an additional advising resource to supplement and support faculty advising within the College of EMS. This allows students to get help with basic questions and draft schedule development prior to meeting with their faculty advisors, thereby reducing the heaviest advising loads during peak registration weeks for faculty. Peer advising is held in a computer lab and allows students to drop in during scheduled open hours for assistance.

To implement the program, the peer advisor positions were advertised and applications were solicited from students with junior or senior class standing with cumulative grade point averages of at least 2.80. A team of eight peer advisors was selected from the pool of applicants. The

selected peer advisors attended a training that included information and skill development on such topics as schedule development, understanding degree requirements, navigating registration software, effective communication, and professionalism.

During the 2014-2015 academic year, 120 students utilized peer advisors. A survey was sent to those students who participated. Results indicated a high level of satisfaction. Key responses are summarized in Table 3.

Table 3: Peer Advising User Survey Results – Key Questions

Question	% Who Selected "Agree" or "Strongly Agree"
The peer advisors were friendly and personable.	95.8%
The peer advisors were knowledgeable.	87.5%
I would recommend peer advising to my friends and/or classmates.	79.1%

Peer Mentoring

At UW-Platteville, there are multiple organizations that utilize peer mentors. One such organization is the Women in Engineering, Mathematics and Science Program. While this mentoring program had existed for many years prior to the implementation of the STEP grant, a grant initiative was developed to build additional infrastructure around the program and improve its effectiveness.

Improvements included making the position of mentor a paid opportunity (previously it had been a volunteer position), requiring log reports of mentor-mentee meetings, and partnering with other mentoring programs on campus to add consistent training for mentors (previously, training and preparation for mentors varied significantly between organizations). The STEP grant team was able to leverage and modify a training workshop developed by the STEM Scholars Program and expand it for use with four campus mentoring groups. Training topics include traits of effective mentors; communication skills and building rapport; ideas for mentor-mentee activities; identifying and responding to bias incidents; and campus resources and support. Using this new workshop, 45 mentors were trained in 2013 and 33 in 2014.

Both the mentors and mentees benefit from participating in the Women in EMS Mentor Program. Each year, a survey is issued to participants to measure their satisfaction and to determine if program goals were met. Key results are summarized in Table 4.

Table 4: Women in EMS Mentor Program Participants Survey Results

	% Who Selected "Agree" or "Strongly Agree"	
Question	Mentors	Mentees
Helped to build an academic network.	94%	81%
Helped to build a social network.	88%	84%
Would recommend the program to other women.	100%	95%

Pre-College Outreach

Deliberate and intentional recruitment is an important part of retention efforts. By strengthening existing outreach programs on campus and expanding participation to include off-campus programs, the STEP grant is helping to generate energy and excitement about engineering, mathematics and science in younger students. For current college students, the opportunity to assist in planning and delivering outreach activities to younger students is an important involvement which can increase their commitment to their discipline. All outreach events are carefully planned to be age-appropriate, socially relevant, inclusive, and hands-on.

Grant initiatives have helped to develop additional infrastructure and make improvements to two existing on-campus outreach programs for young women – Women in Engineering Career Day and Sky's the Limit weekend camps. In addition, a new on-campus program, Dia de Ciencias, for Hispanic and Latino high school students, was created in partnership with the local chapter of the Society of Hispanic Professional Engineers.

Several new off-campus outreach opportunities have also been part of grant efforts. With the present regional and national attention on STEM education, many community organizations are beginning to offer opportunities for STEM exploration. These community organizations often seek partners to offer workshops or host booths at festivals. Grant professional and student staff have been able to participate in 17 such events to date. Overall, during the 2014-2015 academic year, approximately 650 youth in grades K through 12 participated in grant-related outreach events and activities.

Presently, grant staff is involved in launching a new program called Engineering, Mathematics, and Science Ambassadors. This program is a direct result of outreach partnerships and involvements that have developed during the grant period. The program will include a team of six undergraduate students who will develop and conduct outreach activities independently or in small teams. Ambassadors will be able to role model to the youth and communicate accurate information about STEM disciplines using appropriate messaging. They will be trained to work with individuals from diverse backgrounds and to develop activities that are inclusive and demonstrate the depth and breadth of STEM fields. This program will allow the College of EMS to expand its off-campus outreach. The expected benefits of this program are many and include development of presentation and professional skills for the college student ambassadors; exposure to age-appropriate, hands-on activities for the youth participants; and opportunities to promote the university and its STEM programs in the tri-state region.

Challenges and Limitations

There are some factors in the implementation of these initiatives and some limitations to these results which may make the overall process less generalizable to other institutions.

If appropriate organizational infrastructure does not already exist to support expansion or creation of outside-of-the-classroom initiatives, it may be impractical for some institutions to

build the necessary foundation. While many of the grant initiatives have proven effective at UW-Platteville, it is important to note that the implementation did not occur in isolation and many other factors likely contribute to the overall success. An existing department on campus, called Engineering, Mathematics and Science Student Success Programs, is the parent department of the STEP grant and provides important support.

In addition, these initiatives are supported by grant funding. For institutions that do not have grant or budget dollars available to support outside-of-the-classroom initiatives, it may be difficult or impossible to start. Even with initial costs externally funded, the institutionalization and maintenance of the programs, staff, and resources can lead to difficult budget decisions.

Another limitation or caution of applying these initiatives more generally is related to the scope of the project. The objectives of the STEP grant at UW-Platteville are many, and their impacts are intertwined. Part of the effectiveness is in the breadth of offerings. It is unknown how any one initiative alone would impact students.

Recommendations for Practice

1. It is important to have adequate staff to support grant initiatives, and for the staff to have appropriate training and knowledge. Both professional and student staff are essential to the initiatives described. Planning, oversight, and assessment of the programs are best conducted by a professional staff person who spends significant time interacting with the students who utilize the resources. In addition, having a staff that includes student assistants allows for more peer interactions and better connections. Especially in the study center space, being greeted by a friendly face upon entering can contribute positively to users' overall experience. The center can also serve as a hub for many of the other initiatives. By having staff who are knowledgeable about these and other university services, the center can help student users make important connections and access campus resources.

2. It is critical that all grant initiatives be student-focused. This means that students should be included in every step of the planning and implementation process, and that their suggestions should be heard and taken seriously. They should be given many opportunities to voice their opinions via surveys, focus groups, suggestion boxes, and informal comments. In addition, program hours should be selected to provide access that meets students' preferences, even if it may be outside of normal business hours.

3. Above all else, intentional development of university-wide collaborative interdepartmental relationships is crucial to the success of these initiatives. Involving student services offices as much as possible can help to avoid duplication of services, saving money and creating a more seamless experience for students. Faculty and instructor support is also important as they can encourage students in their classes to take advantage of the resources and opportunities. In addition, it is prudent to involve members of campus administration in the planning and

implementation of such initiatives early and often. These campus partners can even be included as members of advisory boards or leadership teams when appropriate.

References

1. Center for the Advancement of Engineering Education. (2010). *Enabling engineering student success*. (Report No. CAEE-TR-10-02). Retrieved from http://www.engr.washington.edu/caee/

2. U.S. Department of Education, Institute of Education Sciences. (2013). *STEM attrition: College students' paths into and out of STEM fields* (Report No. NCES 2014-001). Retrieved from http://nces.ed.gov /pubsearch/pubsinfo.asp?pubid=2014001rev

3. U.S. Department of Education, Institute of Education Sciences. (2015). *The condition of education* (Report No. NCES 2015144). Retrieved from http://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2015144