Increasing STEM Enrollment Using Targeted Scholarships and an Interdisciplinary Seminar for First- and Second-Year College Students

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Abstract

To attract and retain more academically qualified students to science and mathematics, we developed a merit-based scholarship program for incoming students with STEM interests. Scholarship recipients participate for the first two years in an interdisciplinary learning community and declare a STEM major by the sophomore year. STEM Learning Community (SLC), a year-long course initiated in fall 2009, has become a permanent part of the College curriculum. Content consists of weekly meetings for discussions and presentations on such topics as scientific ethics, relationships between science and technology, the nature and history of science, and the interplay between scientific discovery and societal development. A major component are group research projects conducted during the school year and presented at our annual undergraduate research symposium. In addition, we provide career counseling, visits and presentations by STEM professionals, and internship opportunities. Students report that they are developing such valuable skills as problem solving ability, communication skills, collaboration, and knowledge of the research process. Enrollment and graduation data show that numbers of participants, especially women and minority students, increased following the inception of the SLC. The results suggest that targeted scholarships combined with engagement in collaborative undergraduate research are a useful tool for enhancing STEM recruitment and persistence.

Introduction and Rationale

Attracting more students into STEM fields is a national priority (Jackson, 2003). The global economy increasingly requires persons with scientific, engineering, and technological skills. The US can remain a leader in increasing the percentage of adults with STEM degrees in natural sciences, engineering, computer science, and information technology (Committee on Prospering, 2007). Fortunately, there is a consistently high level of US student interest in undergraduate STEM programs, with about 50% of pre-college students indicating an intention to major in a STEM discipline (Committee on Prospering, 2007; ACT, 2014). There is a large gap, however, between the stated intentions of incoming students and their persistence to successful degree completion with a STEM major. In fact, undergraduate STEM programs tend to display the lowest persistence rates among all academic disciplines despite evidence that students who drop out of STEM programs are as qualified as, if not more qualified than, college entrants as a whole (Seymour and Hewitt, 1997).

The first year of college is a particularly risky time during which many students entering with an interest in science or mathematics switch to a major outside the STEM disciplines (Astin and Astin, 1993; Seymour and Hewitt, 1997; Daempfle, 2003-2004; Committee on Prospering, 2007; Graham et al., 2013). This attrition rate may be as high as 60% overall, and even higher for women and minorities (President’s Council of Advisors, 2012). Persistence is reinforced by academic success, however. Risk of attrition from the sciences declines the longer a student remains in college.

Furthermore, historically underrepresented minority groups, which constitute about 25% of the US population and 17.9% of undergraduate students, make up only 2.5% of students in STEM majors and 6% of the entire US science and engineering workforce (Committee on Prospering, 2007). And, although women make up nearly half of the entire US workforce, only a quarter of the science and engineering workforce consists of women (National Science Board, 2004).

Demographers forecast that 42% of the US population will be composed of African Americans and Hispanics by 2050 (Passel and Cohn, 2008). This demographic shift means that racial and ethnic minority students will be composed of African Americans and Hispanics by 2050 (Passel and Cohn, 2008). This demographic shift means that racial and ethnic minority students will be.

Our strategy to increase STEM matriculants through scholarships

To increase the number of STEM matriculants at the college, in 2000 we began a program to offer four-year competitive scholarships to students pursuing a bachelor’s degree in a STEM discipline. The focus has been on several STEM departments at the College—Biology, Chemistry/Physics, Mathematics/Computer Science, and Psychology—that have worked together closely for many years and constitute the main portion of the College’s Division of Science and Mathematics. The principal goals of this program are to improve recruitment and persistence of students in STEM fields at Bethel College and to prepare these students for diverse careers in research, practice, and industry. In 2008, we secured a four-year S-STEM grant from the National Science Foundation to augment our existing STEM scholarship program and attend activities. During the S-STEM funding period, we worked diligently with the College development office to build an endowment to sustain the scholarship program in perpetuity. All scholarship recipients are expected to maintain a specified standard of academic excellence in their college coursework and make reasonable progress in a STEM program of study to retain eligibility. We are persuaded that such a scholarship program, combined with the appropriate student support services, is also an effective means to increase STEM participation by underrepresented minorities and women. In 2006, prior to the initiatives begun under the S-STEM grant, Bethel College’s rates of minority and women STEM graduates were 9% and 33%, respectively, and we hoped to improve these percentages.

Strategies to improve STEM persistence

Persistence in the sciences improves where programs employ cooperative learning strategies to develop peer support or where students are encouraged to participate in research with faculty (Seymour and Hewitt, 1997). Nurturing environments are strong predictors of student persistence in STEM majors, particularly for women and minorities. Such a climate is created through regular contact with faculty, social gatherings with faculty and peers, seminars and discussion groups, support networks, and mentoring experiences.

A key factor for retaining students in STEM majors is assurance that students feel connected to the intellectual and social life of the college (Tinto, 1993; Braxton, 2000). STEM-related extracurricular activities and interactions...
with established scientists, applied mathematicians, and engineers can be powerful motivating forces for students (Committee for Prospering, 2007) and better prepare them for the STEM workforce (Martinic and Carlson, 2003).

Minority and women students have particular support needs (e.g., higher levels of personal attention in the forms of peer mentoring and tutoring; BEST, 2004). Providing these students with opportunities to develop relationships builds support within the cohort group while fostering allegiance to the college, the department, the discipline, and the profession. Our goals to enable students from underrepresented groups to succeed and expand their representation in STEM majors include some additional efforts. We seek for them enriched research experiences that provide hands-on opportunities beyond the classroom and connect learning to the world of work. The various STEM departments provide numerous opportunities where students can assume responsibilities as researchers, peer-mentors, and instructional assistants, and inquiry-based experiences where students engage jointly in efforts that infuse education with the excitement of discovery. Internships and other connections build bridges to STEM professions after college.

The project, with major additional funding through the S-STEM grant, comprises a set of integrated activities designed to enhance undergraduate recruitment and persistence of STEM majors, and encourage successful placement following college in a job or post-college preparation. Thus, this program has three primary interrelated objectives:

- Attract more students into STEM programs, especially students from historically underrepresented groups (women, minorities, family financial need, first generation college)
- Improve persistence to graduation by forming a cohesive learning community and providing attendant support services. Our goal to incorporate students with STEM interests early on and to sustain them via a cohesive learning community includes an orientation at the very beginning of their college career, a learning community to provide collegiality and develop research skills, academic and career services to advance them toward their long-term goals, and programming to facilitate a smooth transition to a STEM major (Graham et al., 2013).
- STEM Learning Community (SLC) is a requirement for all freshman and sophomore recipients of a science or mathematics scholarship, and strongly recommended for others with these interests. In this course students explore scholarly inquiry through readings in the history, philosophy, and ethics of science; web-based conferences; observation and critique of senior thesis projects; presentations on STEM careers and internships; and designing and completing a collaborative research project.

**Orientation for new STEM students**

Although for many years we hosted an informal reception to welcome new STEM students, in 2009 we developed an orientation program for each new cohort of science and math scholars that is more formal and extensive than what had occurred previously. The orientation begins with a noon meal that brings together STEM faculty, the new students, and their parents (if present). A typical schedule for the rest of the day includes of general introductions of new students and STEM faculty, presentations by faculty on the research opportunities available in their labs, career information, brief presentations by current STEM students, and tours of labs. Additional group activities are designed to introduce students to the practice of science and to one another.

These orientation sessions constitute the first class meetings of the STEM Learning Community.

**Interdisciplinary scope**

Careers in STEM fields are becoming increasingly interdisciplinary in scope. Today’s STEM students need a broadly based core curriculum together with an interdisciplinary seminar and adequate foundations in the life and physical sciences as well as in mathematics (National Research Council, 2003). Moreover, the sciences are not separable from other areas of life. Hence, interdisciplinary STEM seminars enhance student learning by demonstrating the relationships among the sciences, mathematics, social sciences, humanities, and arts (Daempfle, 2003–2004). Fortunately, effective pedagogies for enhancing student learning outcomes are not discipline-specific (Kuh et al., 2005, 2007; Pascarella and Terenzini, 2005). For example, problem-based learning that utilizes diverse research teams (diverse in terms of intended majors, year in college, ethnicity/race/ gender) is both active and collaborative and helps develop many of the skills (flexibility, collaboration, intrinsic motivation) essential to form well-educated 21st century citizens (Michaelson et al., 2002; National Research Council, 2010; Kober, 2015).

**Forming a cohesive learning community**

An important aspect of the STEM scholarship program is required participation in an interdisciplinary seminar with peers and faculty beginning in the student’s first year. The new course, STEM Learning Community (SLC), was developed by the authors with support from the NSF S-STEM grant and was added to the College’s permanent curriculum in 2009. In this course, beginning STEM scholars are formed into cohorts that are managed and supported as active learning communities. Such participation fosters a sense of academic community, builds ties to the STEM disciplines, integrates lower-level students with their upper-level counterparts, and provides a support network that encourages ongoing academic success while informing students about career opportunities in STEM fields. The seminar engages students in multiple activities to develop significant relationships with faculty while building and enhancing a cohesive learning community with their peers. Activities are designed to increase excitement in the sciences and awareness about STEM fields, thereby improving the likelihood that students will pursue a STEM-related career after graduation.

Since our scholarship students represent several academic departments, and are pursuing different programs of study, it is important to create events at which students can associate together naturally. To facilitate such interaction, and help integrate STEM students into the life of the college, we schedule special speakers, field trips, receptions, and other common activities. Professional preparation is aided by laboratory or departmental
Students engage in several types of STEM-related learning experiences beyond the classroom from the freshman through senior years. Some of these activities (orientation, seminar) are required of all STEM scholarship awardees; others (departmental employment, internships) are encouraged but not mandatory. Academic counseling is available as needed.

Research experiences

The process of scientific inquiry is key to excellent education in the sciences; conducting active research enables the student to contribute directly to the discovery of new knowledge. Even students who are preparing primarily for professional schools or clinical careers can benefit from research experiences (Trask and Francom, 2009; Shanahan et al., 2015). There is persuasive evidence that undergraduate research helps prepare students for scientific careers; provides a context for active learning, stimulates excitement for STEM learning, and encourages persistence in a STEM career path (Hunter et al., 2006; Lopatto, 2007; Russell et al., 2007). Student preconceptions of science laboratories as stern and uninviting can be counteracted by research experiences (Adedokun and Burgess, 2011; Graham et al., 2013). For these reasons, the National Research Council (2003) recommended that students be given the opportunity to pursue independent research as early as possible. Involvement in a research project allows the student to acquire quantitative skills, perform and interpret statistical tests, and present data graphically, thereby accelerating the mastery of key concepts. Strong undergraduate research experiences provide students with critical thinking and evaluation skills. Communicating the excitement of research is crucial for attracting and retaining STEM students.

The importance of undergraduate research engagement at Bethel is demonstrated by the senior thesis that has been required of all STEM graduates for decades. For the great majority of STEM students, this requirement is fulfilled by designing and conducting an empirical investigation which is reported in a substantial paper, including an extensive review of the literature. For nearly 70 years, an independent research project, conducted on- or off-campus but with the guidance of a Bethel faculty member, has been a graduation requirement for all science majors. Even prior to the senior thesis work, research projects are encouraged by summer grants offered by the college or by faculty members with extramural funding. Competitive summer fellowships are awarded annually in spring following evaluation of student proposals by a faculty committee. In addition to opportunities to conduct research in close collaboration with an in-house faculty member, students frequently work with an off-campus researcher affiliated with a private company, a university, or a national laboratory. Many students apply for NSF-sponsored summer research programs off campus. We encourage STEM students to take advantage of these opportunities whenever possible.

In addition, Bethel science faculty provide inquiry-oriented laboratory experiences, even in introductory courses, as has been advocated in a recent national conference on undergraduate biology education (Brewer and Smith, 2011). Because faculty enthusiasm for research is often “infectious,” it is important to expose students to teaching faculty who are active in research and who integrate their research interests with their regular teaching. For instance, both of us have had research grants that include students as collaborative researchers.

Group projects

STEM Learning Community provides a natural mechanism for introducing lower-level students to the research process and for mentoring by upper-class majors for freshman and sophomore students (i.e., vertically integrated research groups). A hallmark of SLC is the interdisciplinary group project that accompanies classroom content and presentations by speakers. These projects bring together students of different college classes and with different STEM interests in a common research effort. Each interdisciplinary group is composed of three to five students. Students meet together and with their faculty advisor throughout the fall and spring, conduct a literature search pertinent to their topic, collect and analyze data, and create a poster for the college’s annual undergraduate research (Undergraduate Research, Internships and Creative Activity, URICA) symposium.

In the first two years, collaborative group projects were essentially designed by the faculty and presented to students as options. These first generation projects were organized principally around such interdisciplinary topics as climate change, carbon budgets, energy or materials conservation on campus, biodiversity, and public health issues related to climate change. In the latter years, and largely in response to students’ requests for more latitude in choosing their topics, we expanded the range of research possibilities to include more topics in the biomedical and behavioral sciences. Groups conceive research plans, then submit proposals in fall, and post regular progress reports and data files using our Moodle course management software.

URICA symposium

A highlight for SLC students is their participation in the College’s URICA Symposium which takes place in late April and thereby serves as a “capstone” event.
Provide bridges to graduate programs and careers

The third component of the program provides career information and advising to students, especially by incorporating this effort into regular programming of the STEM Learning Community. We invite scientists, medical professionals, science teachers, and prospective employers to provide presentations about science-related opportunities. We have also developed a broad-based internship program (described below) that provides incentives for participation in the form of stipends. The intent is to provide first-hand exposure for our students to STEM-related career opportunities that will encourage them to complete a STEM four-year degree and to pursue science-related graduate or professional study afterward.

Career preparation: internships

A recent report of the Association of American Colleges and Universities identified internships (including undergraduate research) as a high-impact educational practice for achieving the goals of a liberal education (Kuh, 2008). Thus, internships have become signature programs for some colleges (Aldas et al., 2010; Gavigan, 2010, Pierson and Troppe, 2010). A factor important in preparing students for the science and technology workforce is the opportunity for substantive interaction with mentors from science and technology fields. Internships and mentorships often encourage student engagement in learning and intentional exploration of career alternatives, and enable faculty involvement in helping students develop and pursue career aspirations (O’Neill, 2010).

To provide additional components to the STEM Learning Community course and the attendant junior/senior seminar, we are pursuing ways to provide bridges to STEM careers and graduate programs. In summer 2013, we inaugurated a new program, entitled the RICHE (Research and Internships for Careers in Health and the Environment) Initiative, to fund science-related research and internship experiences on or off campus. We have compiled a list of individuals among our STEM alumni representing a wide range of academic, medical, chemical, engineering, and software industries and who could sponsor internships, provide tour of facilities, and promote career opportunities. The core of this alumni base is a 20-member STEM Advisory Council formed in 2006. Since 2013, a total of 16 students have received RICHE funding to support internships. Awardees are required to keep a journal (using Mahara e-portfolio software) in which they comment on their plans and preferences regarding a major and career and how the internship is benefiting them. At the conclusion, students report on their internships to the SLC class and serve on a career panel during the URICA Symposium.

Another aspect of our effort to bridge learning and the world of work is the annual STEM Symposium—a component since 2007 of the College’s annual October alumni weekend event that brings thousands of visitors to campus, including many STEM alumni. The schedule includes research presentations on Friday followed by a panel on STEM career paths. Again, afternoon classes are cancelled to allow student attendance. A reception late Friday afternoon encourages and maximizes interaction between speakers, STEM alumni, and undergraduates. The event closes with a keynote address and STEM coffee on Saturday morning.

Finally, career preparation is thoroughly integrated into the content of the SLC course too. As a class assignment, students are directed to write on their career plans, create an ePortfolio using Mahara, pursue employment in STEM departments, seek research and internship experiences on or off campus, and attend career panels during the STEM and URICA Symposia. These efforts involve extensive collaboration with the College’s Office of Experiential Learning and Career Services, class presentations and assignments, development of on-line resources available through the Moodle site for the course, and invited speakers and other communications with STEM alumni.

Course/program assessments

For interdisciplinary programs like ours, valid forms of assessing the instructional impact on learning should focus on such components as problem solving ability and communication skills as opposed to content knowledge. Thus, we designed a questionnaire specifically to survey students’ perceptions of their academic skills, confidence, knowledge of the research process, research opportunities, career options, career preparation, access to academic assistance, and access to career counseling.

STEM student surveys

To evaluate the success of the program in meeting our objectives during the first four years, we administered end-of-year surveys to the scholarship recipients and to participating STEM faculty. The student survey aimed to assess the scholarship program in terms of its explicit goals (understanding the research process, preparation for a STEM career, etc.). The survey for STEM faculty was designed to gain important information to evaluate the success of the program mid-stream and to identify any areas that needed improvement. Here, we were particularly interested in evaluating and improving our means of promoting our STEM programs and recruiting historically underrepresented student groups.

In general, all the mean scores of student respondents were very strong (between 4.0 and 5.0 on a 1-5 scale),
with students citing especially the financial impact of the scholarship on their ability to attend college and pursue a STEM career, their understanding of the research process, and the level of academic support available to them (Table 1). Students highlighted in particular their strong relationships with STEM faculty, opportunities to learn about the research process, and excellent career preparation. Additional student comments mentioned the confidence and preparation they are gaining for a STEM profession, their increased awareness of career options, and, in particular, the great educational value they experienced in preparing for the URICA Symposium and the close working relationships they enjoyed with STEM faculty. The hands-on aspects of the research process enhanced their understanding of science, and exposure to senior thesis research helped “de-mystify” the process for beginning students.

In the addition to the questions shown in Table 1, in the fourth year we asked graduating scholarship recipients to reflect also on their several years’ experience with the program, and to provide commentary on their studies, career preparation, and suggestions to improve the STEM scholarship program. Many students appreciated the emphasis placed on identifying and exploring their career interests, connecting with alumni working in their area of interest, learning how to formulate questions and develop a full research project, and the importance of integrating younger students into a senior research group.

In response to the relatively low mean scores in the second year reflecting a perceived need for more directed career counseling, we made several explicit changes to increase our efforts in this area. Notably, we began working more in tandem with our Office of Career Services and Experiential Learning (including class presentations to the SLC students by our Director of Career Counseling), and devoted more sessions to career information, including providing numerous links to web sites on the course Moodle site, writing assignments to identify career goals, and assignments on building a resume using Mahara e-portfolio software. Moreover, there were several opportunities for students to speak directly with STEM professionals who visited our campus or via Skype.

In the third year, several students and faculty recognized that juniors were lacking the research opportunities available to SLC students (who were involved in group projects in the first two years) and seniors (who were completing their research theses). In response, we explicitly integrated research groups vertically among classes allows upper level students to assume mentoring roles for beginning students and potentially build upon research projects from one year to the next. There was concern expressed early about providing a seamless transition from freshman/sophomore group projects to senior-level thesis research, which was addressed in the way we re-formulated collaborative research groups.

Reflected on the degree to which the project is increasing overall enrollments in science and mathematics, several faculty members commented that the scholarships, integrated with SLC and career advising, has revitalized our entire science program. Students are considerably more involved in their STEM majors now, and appear much more capable of conceiving and putting together research projects, than they were a few years ago. Faculty members also appreciate the opportunity to mentor students earlier in their educational training to encourage an interest in science and to discuss career opportunities. There is increased awareness among students of the need to be systematic in preparing for a STEM career.

In the inaugural year, faculty identified some difficulties in moving beyond traditional approaches in recruiting students; need for more outreach, especially to minority students; still insufficient institutional support for recruitment; and ineffective advertisement and promotion of the scholarship program. We succeeded in overcoming many of these barriers through a generally cooperative frame of mind among STEM departments and better communication among faculty, Admissions, the Financial Aid Office, and students. In the opinion of the authors, however, recruitment of minority students into STEM disciplines continues to lag behind expectations. Thus, we continue to seek more minority and female students in the sciences, and are exploring new ways of marketing to them. For example, six years ago we began a partnership with the Upward Bound Science and Math program at nearby Wichita State University to identify and sponsor in particular minority and first-generation college students for our annual Summer Science Institute.

**STEM Learning Community student evaluations**

Evaluation for the SLC class was a part of the College’s regular program of course evaluations to assess instructors’ effectiveness in delivering course content. The format of the evaluation changed from the 2010/2011 to 2012. Values are means of scaled responses where 1=disagree strongly and 5=agree strongly. Responses are ranked by decreasing overall three-year score.

<table>
<thead>
<tr>
<th>Evaluative statement</th>
<th>2009/10</th>
<th>2010/11</th>
<th>2011/12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meaningful opportunities to conduct research were provided</td>
<td>4.6</td>
<td>5.0</td>
<td>4.5</td>
</tr>
<tr>
<td>Students were given both academic and personal support</td>
<td>4.7</td>
<td>4.8</td>
<td>4.2</td>
</tr>
<tr>
<td>Students are improving their understanding of the research process</td>
<td>4.5</td>
<td>4.8</td>
<td>4.2</td>
</tr>
<tr>
<td>Students are enhancing their academic skills</td>
<td>4.5</td>
<td>4.8</td>
<td>4.0</td>
</tr>
<tr>
<td>Students are moving toward the planned goals of the project</td>
<td>4.4</td>
<td>4.2</td>
<td>4.1</td>
</tr>
<tr>
<td>The appropriate students were selected to receive a STEM scholarship</td>
<td>4.3</td>
<td>4.2</td>
<td>4.0</td>
</tr>
<tr>
<td>The number of students entering a STEM program is increasing</td>
<td>4.0</td>
<td>4.0</td>
<td>4.3</td>
</tr>
<tr>
<td>The number of prospective STEM students reached is increasing</td>
<td>4.0</td>
<td>4.2</td>
<td>3.7</td>
</tr>
<tr>
<td>Students are being retained in STEM programs at an increasing rate</td>
<td>3.8</td>
<td>4.0</td>
<td>3.3</td>
</tr>
<tr>
<td>I encountered barriers to implementing this program</td>
<td>3.0</td>
<td>1.5</td>
<td>3.0</td>
</tr>
<tr>
<td>A solid management plan was developed and followed</td>
<td>4.6</td>
<td>4.2</td>
<td>--</td>
</tr>
<tr>
<td>The recruitment strategies were successful</td>
<td>3.8</td>
<td>4.0</td>
<td>--</td>
</tr>
<tr>
<td>Appropriate recruitment strategies were employed</td>
<td>3.8</td>
<td>3.7</td>
<td>--</td>
</tr>
</tbody>
</table>

**TABLE 2.** Results of mid-program evaluations administered to participating STEM faculty in 2010, 2011, and 2012. Values are means of scaled responses where 1=disagree strongly and 5=agree strongly. Responses are ranked by decreasing overall three-year score.
the 2011/2012 academic years, thus the results are not directly comparable across the four years.

Responses to the surveys administered to the SLC students in the first two years showed that, in general, students responded well to this interdisciplinary course (Table 3a). Students mentioned that they appreciated the opportunity to hear progress reports from juniors and seniors working on their thesis research, group discussions on ethics in science, history of science, collaborative hands-on study of a common topic, presentations by guest speakers, and participation in the URICA Symposium. Students commented further on the value of the research experience in preparing for graduate school, how exposure to senior thesis presentations helped beginning students generate project ideas of their own, the importance of career sessions, and the educational experience gained through reading and critiquing scientific papers.

When asked about ways to improve the teaching or content of the course, a few students cited the large time commitment involved in completing group projects, questioned whether there could be more latitude in choices of topics for group projects, and recommended greater integration among beginning and more experienced students.

Responses to the survey administered to the SLC students in the third and fourth years showed that, in general, students were continuing to respond favorably to this interdisciplinary course, with nearly all scores falling within the ‘agree’ and ‘agree strongly’ categories (Table 3b). When asked to identify which aspects of the teaching or content of the course students found especially helpful, most students mentioned the group projects, the hands-on nature of the course, and the instructor’s expertise, availability, and willingness to assist. Several students appreciated in particular the skills they developed in conducting research and completing a scientific poster, and that they enjoyed collaborating with juniors and seniors.

STEM faculty benefit from the SLC experience, too. The program provides faculty with various opportunities to work with a diverse group of students, both in terms of students’ backgrounds and in disciplinary interests. Faculty members gain experience in finding engaging readings for this diverse group, and working together across departments to provide common content. Instructors have also gained expertise in finding integrative themes for research that span multiple disciplines and guiding first-year students in developing researchable questions.

A main objective of our scholarship program was to attract more students, especially women, minorities, and first-generation college students, into STEM majors (Objective I). Three metrics are useful to examine progress toward meeting this objective: (1) enrollment in and demography of STEM Learning Community as an indicator of freshman/sophomore interest in STEM majors, (2) enrollment and demography of STEM students involved in junior/senior seminar courses, (3) number of graduates with STEM majors for the previous five years.

**Enrollment in STEM Learning Community**

One indicator of the progress made toward meeting Objective I is the number and makeup of students enrolled in the freshman/sophomore interdisciplinary course, STEM Learning Community. This enrollment provides a gauge of both early interest in STEM and potential number of majors and graduates a few years hence. Involvement in SLC ranged from 19 to 32 students annually during this period (Table 4). Averaged across years, the course membership was predominantly female (64.5%) and had a minority student constituency of 9.7%. Six years is insufficient time to identify strong trends, but the numbers in the last four years certainly represent higher proportions of women and minority students than in the first two years. Of course, not every student who enrolls in SLC in their first two early years ultimately majors in STEM. These figures, however, are strongly indicative of eventual formal STEM involvement.

<table>
<thead>
<tr>
<th>Academic Year</th>
<th>Enrollment</th>
<th>Total (%)</th>
<th>Minority</th>
<th>Total</th>
<th>Minority</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>female</td>
<td>female</td>
<td>male</td>
<td>male</td>
</tr>
<tr>
<td>2009-2010</td>
<td>19</td>
<td>11 (57.9)</td>
<td>1</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>2010-2011</td>
<td>26</td>
<td>11 (42.3)</td>
<td>1</td>
<td>15</td>
<td>0</td>
</tr>
<tr>
<td>2011-2012</td>
<td>30</td>
<td>19 (63.3)</td>
<td>3</td>
<td>11</td>
<td>2</td>
</tr>
<tr>
<td>2012-2013</td>
<td>25</td>
<td>21 (84.0)</td>
<td>1</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>2013-2014</td>
<td>23</td>
<td>17 (73.9)</td>
<td>2</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>2014-2015</td>
<td>32</td>
<td>21 (65.6)</td>
<td>2</td>
<td>11</td>
<td>0</td>
</tr>
</tbody>
</table>

**TABLE 4.** Enrollment in the STEM Learning Community course during its first six years.
In terms of meeting the goals of increasing the numbers of STEM students, especially among women, minorities, and students with large financial need, the program is clearly making progress. The enrollment and demographic indicators all changed positively, although additional years are required to determine whether these trends hold for the long term. Beyond providing essential financial support for students in STEM, the scholarship and academic support program has led to significant institutional change, notably in the creation of the course STEM Learning Community, which has now become a permanent part of the Bethel College curriculum. The SLC class, perhaps the most visible success of the program, has, with some minor adjustment, achieved all the objectives we set out to accomplish. This class provides beginning college students exposure to STEM disciplines in a way that never existed previously on our campus.

Conclusions

In terms of meeting the goals of increasing the numbers of STEM students, especially among women, minorities, and students with large financial need, the program is clearly making progress. The enrollment and demographic indicators all changed positively, although additional years are required to determine whether these trends hold for the long term. Beyond providing essential financial support for students in STEM, the scholarship and academic support program has led to significant institutional change, notably in the creation of the course STEM Learning Community, which has now become a permanent part of the Bethel College curriculum. The SLC class, perhaps the most visible success of the program, has, with some minor adjustment, achieved all the objectives we set out to accomplish. This class provides beginning college students exposure to STEM disciplines in a way that never existed previously on our campus.

Acknowledgments

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References


### Table 5. Enrollments in STEM (biology, chemistry, computer science, mathematics, physics, and psychology) junior/senior seminars 2008 through 2015.

<table>
<thead>
<tr>
<th>Academic year</th>
<th>Combined enrollment</th>
<th>% women</th>
<th>% minority</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008-2009</td>
<td>34</td>
<td>41.2</td>
<td>5.9</td>
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Jon K. Piper is Professor of Biology at Bethel College and currently chairs the Division of Sciences and Mathematics. He holds degrees in Biology and Botany from Bates College and Washington State University, respectively. His teaching and research interests address various environmental and conservation issues, particularly the ecological restoration of grasslands and forests, and he has received several grants to support this work. Piper is a strong proponent of undergraduate research, typically overseeing 6 to 8 student research projects per year.

Dwight Krehbiel is Professor of Psychology at Bethel College in North Newton, KS. He earned a Ph.D. in physiological psychology at the University of Wisconsin-Madison in 1978. He teaches courses in psychology, biology, and applied statistics and serves as coordinator of the STEM Learning Community described in this article. His research with undergraduate students concerns various topics in cognitive neuroscience. Dr. Krehbiel has been principal or co-principal investigator on a number of National Science Foundation grants and is a frequent panelist for the Division of Undergraduate Education and the Division of Graduate Education of the NSF.